A MANUAL

OF

PHOTOGRAPHIC MANIPULATION,

TREATING OF

THE PRACTICE OF THE ART;

AND

ITS VARIOUS APPLICATIONS TO NATURE.

BY

LAKE PRICE.

SECOND EDITION.

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PREFACE

TO THE

SECOND EDITION.

In preparing a new edition of this work the author has profited by the opportunity to revise, correct, and considerably augment many subjects respecting which more information has in the interval been obtained, and in describing which he is enabled to lay before the reader much closer data, derived from the practical working out of most of the varied applications of Photography. PREFACE.

The section on Lenses has been entirely rewritten, for the reason that recently many additions have been made to the various qualities of these instruments; whereby different treatments, according to varying requirements, can be successfully adopted.

In Astronomical Photography he has to acknowledge his obligation to that early and most successful operator, Dr. Warren de la Rue, for his kind revision and additions to the article. Whilst in Photo-micrography he is enabled, by the kindness of Dr. Maddox, to give precise details of the

PREFACE. nice manipulations which, originated, or skilfully carried out by him, have rendered his transcripts of the wonders revealed by the microscope amongst the most perfect hitherto seen.

To those eminent opticians Mr. Dallmeyer, Mr. Ross, and Mr. Voigtländer (through his representative Mr. Callaghan), he is indebted for the extreme liberality with which all sorts and sizes of lenses, when they did not happen to be in his collection, have been placed at his disposal for the elucidation of the subject, and also for much useful information respecting them.

In conclusion, he hopes that the description of the manipulations and varied applications of this most interesting art which, without any reservation, he lays before the student, may smooth some difficulties, save perplexity and needless expense, and assist in advancing it to its further perfection.

LONDON; *June 1st*, 1868.

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A MANUAL

OF

PHOTOGRAPHIC MANIPULATION.

INTRODUCTION.

THE feelings of curiosity and astonishment with which the discovery of Photography and its earlier productions were regarded, have now sobered down by our intimate and daily acquaintance with its results in some one or other of the numerous directions in which its powers are applied. INTRODUCT. Photography;

Still the very fact that it has become a common-place, proves its extreme popularity; and the most indifferent of the pictures of its followers is not without its value in the diffusion of knowledge, the creation of a feeling for Art, and an increased appreciation of the infinite wonders and beauties of Nature, in individuals who, without the facilities which it has given, would probably have remained entirely strangers to such enjoyments. its popularity and advantages.

In a multiplicity of ways, Photography has already added, and will increasingly tend to con- Its applications.

tribute, to the knowledge and happiness of mankind: by its means the aspect of our globe, from the tropics to the poles,—its inhabitants, from the dusky Nubian to the pale Esquimaux, its productions, animal and vegetable, the aspect of its cities, the outline of its mountains, are made familiar to us.

The traces of those generations long ages since passed from its surface, who, with the inherent feeling of our kind, have striven to leave to a dim posterity, by their gigantic but decaying efforts, some relic and memento of their passage; all have been or will be brought in intense reality to our very hearths.

Nay, passing even beyond in its career, already have the appearances of the firmament, of the photosphere of the sun, the minutiæ of the planets, and of our satellite, been noted with unerring accuracy; the mysterious currents of electricity, and the movements of our atmosphere, are by its means exactly registered; the marvels disclosed by the microscope are faultlessly delineated, and in these, as in all directions, we cannot put limits to its scope and powers.

The antiquary and architect are indebted to it for such faithful images of the objects of their pursuit and study as they have never previously seen,—the mechanist and the engineer may take their compasses and measure the parts of each engine, viaduct, or bastion, which nature's drawing has laid down to scale for them. The artist and the dilettante have transcripts of the distant and scattered masterpieces of Raffaelle and Titian,

of Velazquez and Murillo, brought together and united for near comparison in their folios; not as mere diluted translations by the hands of others, but with their own touch, feeling, and power; having now, moreover, by the recent perfecting of the "Carbon printing process," the satisfaction of feeling that the precise counterparts, even to the *colour* of the chalk employed, of the expressed first thoughts of the art-giants of the sixteenth century—which have come down to us, on paper, unscathed after a lapse of more than three hundred years—will many of them also survive and be in existence at a still more distant interval from the present; and that when the calamity occasionally occurs of the destruction of any of the great originals—as has happened recently, by fire, to the masterpiece of Titian, the 'Peter Martyr' —often cited as the first picture of the world—*fac similes* so wonderful that but a few years ago they would have brought immense sums as the original drawings, will be left behind, scattered broadcast over the world, by that condition and their each containing the power of unlimited and continued reproduction defying total annihilation.

INTRODUCT. and the Fine Arts.

Drawings by the great masters.

The emigrant and traveller, far from their early home, send mementos from distant climes, of halts under sultry skies, in which, surrounded by strange, swarthy figures, and shaded by the luxuriant vegetation of the tropics, the elephant and camel browsing beside them, those dear to them in distant England see the familiar face from which they may long be separated. Amidst the icy barriers which have been placed to guard

The Emigrant and Traveller.

INTRODUCT. the hidden mysteries of the Poles, those who have had the daring to endeavour to penetrate their awful solitudes have made use of Photography to bring away the impress of them.

Familiar uses. From Australian cabin, from Canadian log-hut, come images of faces born on that distant soil, akin in blood, yet strangers to those at home who bear their name,—even the humble artisan and lowly cotter, heretofore deprived from indulgence in such natural feelings, may see the mementos of those who are, or have been, dear to them, upon the walls of their modest dwellings.

Historical uses. Posterity, by the agency of Photography, will view the faithful image of our times; the future student, in turning the page of history, may at the same time look on the very skin, into the very eyes, of those, long since mouldered to dust, whose lives and deeds he traces in the text.

Its public importance As this art progresses to perfection, each impressive public ceremonial will be registered and delineated; nay, even the very turmoil of the distant battle or siege and their varying aspects will be instantly fixed and transferred, with the actors, to the page of history, by an art to which the delineation of thousands of figures or of a blank paper present equal facilities of execution. in fixing passing events.

Summary. The foregoing are some of the benefits which Photography has conferred on art, on science, and on mankind; and, when arrived at its more mature development—reflecting on all that has been done in the few years which have elapsed since its discovery—we need not despair of further surprising advances; for we must not at all con-

sider that it has attained the limits of its perfection. Much yet remains to be done by all interested in its advancement, and it is to be hoped that their efforts will, in their several departments, be successful. INTRODUCT. Anticipation for its future

To the natural philosopher we must turn for new discoveries in those mysterious combinations of LIGHT, HEAT, and ELECTRICITY, which may advance our knowledge of their united action, and possibly might result in giving us not only form, but colour, in the picture. To the mathematician and optician we look for lenses, in the performance of which the operator may not feel himself fettered and his picture limited in size; or if he increase its dimensions, that want of intensity, weakness of definition, distortion in the proportions of the figure, and shallowness of focal depth, may not result—qualities in which, at present, more perfection is greatly needed, and which advances, if successfully accomplished, will raise the character of the instrument, and enable it to fulfil completely and satisfactorily the uses for which it is intended. To the chemist for those improvements or new combinations in the materials used in the process, which shall considerably abbreviate the time necessary for the production of the image. And, finally, to the artist, for that judicious selection and arrangement, whatever his materials may be—for everything in nature, even to the smallest weed, has beauties and capabilities—that the pictures we shall see may show marks of reflection and intelligence, and conformity to those rules of art, in the composition of their lines, and effect of

from the optician, (Improvements necessary in portrait-lenses.) chemist, and the artist.

 their light and shade, which will cause them to be looked upon with the respect and interest the exquisite beauty of Nature's own drawing should inspire, when not marred by the unskilful translation or promiscuous selection of her votaries.

THE

DISCOVERY AND PROGRESS

OF

PHOTOGRAPHY.

WITHOUT entering at much detail into the history of the discovery of the power possessed by light to fix, under certain chemical conditions, the image of objects in nature upon a plane surface, a work upon photography would be obviously incomplete were the rise and progress of the art passed over in silence. HISTORY.

Photography, as its name implies, is the art of *drawing by light*, which indeed is not, strictly speaking, correct, since the most illuminating portion of the sunbeam is precisely that of least photographic action. Origin of its name.

Thirty years have not elapsed since, in artistic and scientific circles, the greatest interest was excited by rumours of the fact, that Daguerre the artist—well known to our public by his dioramic pictures—had succeeded in what had often been desired, and as often been pronounced hopeless, namely, in giving permanence to the picture produced in the "camera-obscura." The earliest results shown in London, in 1839, were marvellous representations of public monuments in Paris, views on the Seine, &c., depicted with a minutia and accuracy which astonished the beholder; they were on metal plâques, and were Discovery by Daguerre. Its first results.

HISTORY. executed by the process since called, after its inventor, *Daguerreotype*. But though wonderful in the delicacy of their finish, the reflexion from the bright surface was found objectionable, nor did they possess any power of reproduction.

Their nature.

Fox Talbot's discoveries.

Simultaneously with the discovery by Neipce and Daguerre in France, our own countryman, Mr. Fox Talbot, had perfected researches upon which he had been engaged in the same direction, and the result was, in 1839, made known under the name of the Talbotype or Calotype, which differed from Daguerre's, inasmuch as it was on paper, and the picture being negative, that is, with the lights and shadows reversed, it possessed the power of a plate or *cliché*, from which an unlimited number of proofs might be printed, the diaphanous texture of the paper used allowing the passage of sufficient light.

Calotype.

But this process had likewise its disadvantages, although they were in another direction: it was too slow in receiving the action of light, to be advantageously applied to portraiture and the life, and was deficient in finesse and delicacy of execution when landscape, architecture, and still-life were treated by it.

Its qualities.

Matters stood thus when Mr. Scott Archer, in 1851, communicated to the public a new method of taking the photographic picture by means of a thin film of collodion, extended on the surface of a glass plate, and rendered sensitive to light by being treated with salts of silver. It was found in practice to combine the excellences of all previous methods, and possessed, besides, some peculiarly

Collodion process discovered.

its own. It had more rapidity of action than even Daguerre's process; it could be manipulated at infinitely larger sizes, and had an unlimited power of reproduction, of which his was incapable; and it surpassed Mr. Talbot's by its incomparably greater sensitiveness, its superior discrimination of textures, and minuteness of detail. HISTORY. Capabilities and excellence.

The Collodion process may be said to have superseded all others. Its qualities have, in practice, been found available for every conceivable subject, which during the years elapsed since its discovery have been treated by its means and during which period no other method has been produced at all comparable in merit to it. Popularity of the process.

Such are the main phases of discovery and improvement in this wonderful art, from the first successful results, in 1839, to the present time; for, although many ingenious theorems have, during the interval, been propounded, they have either been found abortive in practice or, their qualities in various ways being inferior to the Collodion process, have been allowed to fall into desuetude. It would, therefore, serve no purpose to detain the reader by the bare enumeration of them; the intent of this volume being to describe, with considerable minuteness, the processes of the one found to give results of the greatest excellence, and by that necessary prolixity, to spare the student many disappointments, and enable him, by strictly following fixed details, to produce with much certainty a successful photographic picture. Other methods less satisfactory. Attention to minutiæ necessary.

PART I.

THE

PRODUCING AGENTS DESCRIBED.

ON LIGHT.

LIGHT. Its Nature.

BEFORE proceeding to describe the manipulatory processes, it will be proper to consider the nature and action of the chief producing agent—Light—and to observe those qualities in its composition and influence which more immediately regard the formation of the photographic image.

Sources of Light;

Light is that principle which emanates from all self-luminous bodies, such as the sun, the stars, also from electrical sources, incandescent earths or metals, and the flames or sparks given out from the combustion of solid bodies or gases; and it is reflected, with more or less intensity, from every object in nature, according as the structure and surface of each may be more or less fitted by the arrangement of its components, to reflect, disturb, or absorb its action.

Of all the astonishing changes, mainly set up by its influences, which are continually going on around us, none exceed in interest those on which the art of photography depend.

Its qualities enumerated.

There are several distinct qualities in light, each of which enter in some shape or other into the

production of the photographic picture. They are intensity, reflexion (regular and irregular), refraction, dispersion, and absorption. LIGHT.

Intensity due to the source, Intensity is the quality which may either arise from the power of the source, as the sun compared with a taper, or the greater or less density, in quality or quantity, of the medium it has to traverse to arrive at a given point; thus the submarine diver receives a diminished light in proportion to the increase of his descent, and in the profound depths of the ocean darkness alone exists, since even the light of the sun is powerless to traverse the accumulated waters. On the contrary, on the summits of lofty mountains the rarified atmosphere permits us to see the stars in novel and surpassing brilliancy, compared to our usual view of them, and to discern many whose light was too feeble to reach our vision, through the lower strata of the earth's atmosphere. or the medium traversed.

Reflexion, regular, its nature: Reflexion is "regular" when the beam of *white* or sunlight falls upon polished surfaces of metal, or mirrors, and is transmitted from them in its integrity; that is to say, as *white* light.

It is "irregular" when it falls upon bodies and surfaces so constructed that they take up certain portions only of the coloured rays composing white light, and *reflecting* those tints alone, and *absorbing*, or rejecting, the rest, the objects themselves become to our senses *coloured*, not by any pigment they intrinsically possess, but by the varying shades of power of affinity and appropriation, which their molecules have for reflecting individual rays, which are the components of light. irregular, its results

LIGHT.

its action illustrated,

The foregoing may be familiarly illustrated thus—we look at a crowded thoroughfare, we see in their varied and appropriate hues, granite, cloth, velvet, bricks, tiles, &c.; every object has its "*local colour*"—this is due to irregular reflexion: a smart shower comes on, the result is that all those surfaces become wet; they then reflect regularly, so that in the camera, as to the artistic eye, pavement, tiles, cloth, &c., all lose colour, and are expressed by *white* light.

on terrestrial bodies,

and on the atmosphere,

Irregular reflexion, or dispersion, of light is the prime motor of all that is beautiful as *colour* to our senses, the aqueous globules of the mid-day silvery cloud are its varying mirrors, which anon it tinges with the colours of the spectrum in the rainbow; the rosy hues of dawn and gorgeous tints of sunset are the results of its diversified action; the endless varieties of colours, seen throughout nature, are due to its mysterious influences, reflected from myriads of facets; as has been said, *of themselves* they have *no colour;* palpable to touch some may be, hideous and livid they would by certain combinations of light appear; by the glorious sun's ray they glow resplendent in magic hues of varied beauty.

gives *colour* to objects.

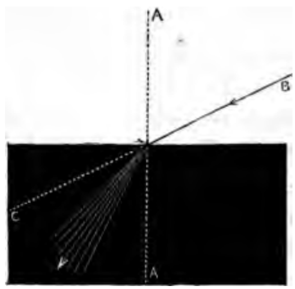
Refraction is the quality which a beam of light possesses in passing from a medium of one density, as air, to another, as water, glass, &c. When it strikes upon such media at a right angle, as A A, it passes straight through them without changing its direction; when it impinges upon them in an oblique direction, as B C, the ray is bent in its passage, and the angle of its

Refraction; its nature.

deviation is governed by the nature and density of the medium into which it enters. Advantage is taken by the optician of this quality of light, he uses in his lenses glass of different degrees of density, the nature of one sort being to disperse the beam of white light; the result is, that the coloured fringes of the spectrum surround each object, one of another quality is superposed, and the various rays are reunited and white light or achromatism results.

Light. its optical qualities. Chromatics.

Fig. 1.



Dispersion is the separation of a beam of white light into its component rays, which vary from each other in colour and in refrangibility. When such a beam falls obliquely upon the surface of a prism, it is not refracted from it in the same state, but undergoes a division which enables us to submit its various parts to analysis.

Dispersion.

If a hole be made in a shutter a beam of sunlight, in passing through it, will be received on a piece of white paper as a round white spot; but if a prism be interposed in the ray, the result will be that the image on the paper will be altered from a white circle to an elongated figure, composed of a series of tints, symmetrically arranged, and which are always, when proceeding from the same source, identical in their disposition and colour, each

The means of separating the components of light.

LIGHT. possessing qualities which differ widely in their nature; this is the decomposition of light, and the result is called the SOLAR SPECTRUM: its divided parts can be recombined in a variety of ways, all having for their purpose the uniting of the coloured rays. This may be effected by receiving them on a double convex lens, in its focus a *white* spot will appear—which is indeed a minute image of the sun—each coloured ray may be separately reflected from one of seven plain mirrors, so adjusted that they may be converged to one point, when white light will be the result; by rotation and several other methods.

Solar Spectrum.

How recombined.

Spectra from other sources.

When the spectrum is formed from other sources of light than the sun various changes are observed in its appearance, by the omission of some of its tints, or by change in the locality of others; but in the main the various spectra offer salient points of resemblance, and some of them are capable of impressing a Photographic image of greater or less intensity.

Brewster's theory.

Newton's theory.

Sir David Brewster considers that white light is composed of the *three* primary colours, blue, red, and yellow; and that the *seven* colours described by Sir Isaac Newton are formed by the overlapping of the edges of the rays of the three, each having its maximum intensity at the parts where the strongest and brightest tint of that colour exists in the compound spectrum; that is to say, red and yellow forming orange, blue and yellow green, &c.; be that as it may, this much is certain, that *three* distinct qualities—namely, LIGHT, HEAT, and ACTINISM—are definitely referable to

The spectrum,

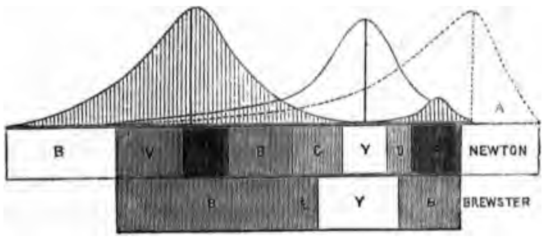
LIGHT.

distinct portions of the spectrum: illuminating power or light to the yellow, heat to the red,

Fig. 2.

MAXIMUM OF

ACTINISM. LIGHT. HEAT.



SOLAR SPECTRUM.

A. Extra rays of heating power beyond the red.
B. Invisible rays of photogenic action beyond the violet.

qualities of its components;

and, according to Dr. Herschel, to the invisible rays beyond the red; and electrical affinity and the quality termed actinism, which is the main producer of the photographic or chemical action, to the blue and to certain rays beyond that end of the spectrum, which were discovered by Professor Stokes, and which are invisible to the unaided vision.

means of demonstration.

The illuminating quality of the yellow ray is judged by the eye. The second—heat—was proved to reside in the red by experiments made with delicately constructed thermometers, by Dr. Herschel and Sir Humphrey Davy, who found that at a point an inch and a half below the extreme red the invisible rays exercised a heating

LIGHT. Heat. power, even when the thermometer was placed at a distance of fifty-two inches from the prism.

Sir Henry Englefield gives the following scale, resulting from his experiments:

	Temperature.		Temperature.
Blue . . .	56°.	Red . . .	72°.
Green . .	58°.	Beyond red .	79°.
Yellow . .	62°.		

On returning the thermometer from beyond the red into the red ray, it again fell to 72°.

Actinism. The quality existing in the blue, violet, and *extra* violet portions of the spectrum, is that of the greatest importance to the Photographer; as it is chiefly by those rays that the action is impressed which forms his picture.

The early researches of Scheele in 1801, of M. Rittner of Jena, of Dr. Herschel, and Dr. Wollaston, all resulted in refering the power of decomposing salts of silver, now termed "actinism," to the before-named rays, and subsequent investigations have confirmed the fact.

Decomposes salts of silver.

The accompanying diagram will show the nature of the action on the position of the various parts of the spectrum in the photographic picture. It will be observed that the part opposite the lightest ray—the yellow—remains unaffected, whilst the gradations of tone up to pure white in the blue and violet give the comparative increase between the two extremes.

Action of the spectrum on them.

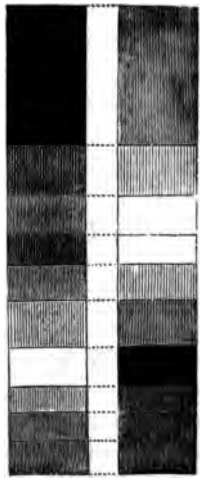
We thus perceive the reason that the photographic action is often deficient when apparently the light is sufficiently intense, since the foregoing

analysis proves that the *visual* ray is not the one to which we are indebted for the picture; on the contrary, sensitive surfaces may be exposed for any periods in that ray unaffected, provided means are taken to protect them from the diffused light which scatters from the prism, or from the action of the other rays.

LIGHT.

Illuminating rays not actinic.

Fig. 3.



Visible Spectrum. Spectrum of photographic action.

We will do no more than notice that various experiments have been made at different times which refer a distinct and powerful magnetic action to the violet rays, many successful results have been obtained in polarizing needles and adding to the power of magnets; but on this point there is considerable controversy, and the question has yet to receive elucidation in common with much that is entirely obscure in the occult principles of light, heat, and electricity.

The violet rays magnetic.

The last quality of light, or rather condition to which it submits, is *absorption*; this term is used when the illuminating principle is too feeble, the

Absorption.

LIGHT. distance it has to traverse through different media is too great, or, the nature of the bodies on which it impinges not being favorable, by their structure, either to its reflexion or refraction, it becomes absorbed and stifled.

Nature of absorption. When an attenuated beam of light is admitted into a darkened room, it will illumine an object close to the aperture where it enters; retire the object further and further, and its obscurity increases, until a limit may be soon reached, in a large apartment, where its illuminating power Illustrated. ceases entirely; this is caused by the absorption of light.

Another kind of absorption is caused by the structure of surfaces, which being, like velvet, bricks, cloth, &c., porous, and offering few or no reflecting portions, the particles of light enter their numerous minute recesses and are extinguished.

It will be well that the student should note the whole of these qualities of light, since they enter intimately into the practice of Photography, either in the management of the lens and diaphragm, or Study of light necessary. in the selection and arrangement of the picture, and governing, as they do entirely, the whole process; conformity to their nature will be the only method of arriving at successful results.

THE EYE AND THE CAMERA.

THE EYE. Our means in Photography of forming an imitation of the image which is presented to the mind Its action imitated by camera. by that most wonderful and perfect organ the eye, are the lens and the camera; and as the picture

which we produce is judged entirely by its conformity with the appearances produced by the same objects in the human eye, it will be well to examine the structure of that organ, and compare the manner in which it performs its functions with the conditions imposed on us by the camera, so that we may see the points in which consist our greatest disadvantages; in order to do what is possible to assimilate their action, or at all events not to increase, by injudicious treatment of our instruments, the distance, already too great, which separates the two.

The necessity of assimilating the results.

Analysis of the eye.

The human eye is of a spherical form, and about an inch in diameter; the small circular disc in front, called the *cornea* (A), being prominent beyond the other portion. Within the cornea is a small chamber (B) filled with a transparent liquid called the *aqueous humour,* which

Cornea.

Fig. 4.

may be considered the front lens, and on which

THE EYE. the rays proceeding from external objects first impinge. The posterior surface of the aqueous humour is limited by the *iris*, which is in fact a diaphragm, by the instant dilation or contraction of which the aperture in its centre (C) called the *pupil* is, according to the intensity of the light, expanded or diminished. Its diameter varies, from little more than a sixteenth of an inch in intense light, to above one quarter in comparative obscurity. This movement, which may be observed by approaching or retiring a candle near the eye, regulates the proper quantity of light on the retina.

Aqueous humour.

Iris.

Pupil, regulating the amount of light admitted.

On looking from distant objects to those immediately near, a contraction of size of aperture takes place in the pupil, and *vice versâ*, the intention of which movement is to admit more light into the retina for the distant objects, and to diminish it and suppress the obliquity of the lateral rays in near ones.

Crystalline humour;

Immediately behind the iris there is a capsule, in the form of a double-convex lens (D), which is called the *crystalline humour* or lens. This plays a most important part in the functions of the organ; by means of the alterations which take place in it, probably by the changes in its form and relative distance between the iris and the retina, the process of focusing objects at different distances is performed. Much discussion has taken place on this point, but the experiments of Dr. Young on persons deprived of this lens, and who were thereby incapacitated from focusing their sight, seems to put the question of the

power of altering the focus

power possessed by this portion of the eye beyond doubt. THE EYE.

A familiar exemplification of the act of focusing the sight is given by placing one object at a yard distance from the eye, and another at six beyond it; on looking intently at either we *are conscious of the presence* of the other, but we do not discriminate its details; on fixing one we lose the definition of the other. exemplified.

The next chamber (E) is filled with the *aqueous humour*, through which the rays pass until they, in the most true and perfect conditions of focus, impinge upon the curved surface of the *retina* (F), depicting the image upon it. This may be seen by carefully dissecting the hinder part of the eyeball of an ox recently killed, so as to lay bare the retina: if it be now placed in an orifice in a shutter, corresponding to it in size, an observer in a dark room will see the images of objects without depicted upon it in an inverted position, remarking only that as the power of adapting the focus of the eye to the planes of distances which existed in the animal alive, may or may not be more or less defective in the unconscious organ, according as the objects presented to it may by their proximity be in harmony with the conditions it happens to possess. Aqueous humour. Retina, shown to be the recipient of the image;

The size of that portion of the retina which receives the image is, in the human eye, not so large as a sixpence,* and when we consider the its diminutive size;

* For an exposition of the wondrous structure of the human eye, especially the retina and optic nerve, see Kölliker, 'Manual of Human Microscopic Anatomy,' p. 537, *et seq.*

The Eye. difficulties of imitating its action. marvellous power of sensitiveness to infinitesimal gradations of tone, and the more than microscopical delineation of form which it possesses, together with the perfect adaptation of aperture and perfection of focus, we become sensible of the difficulties with which the effort is surrounded, to produce by optical science an imitation in the camera of the same appearances presented to the mind through the eye.

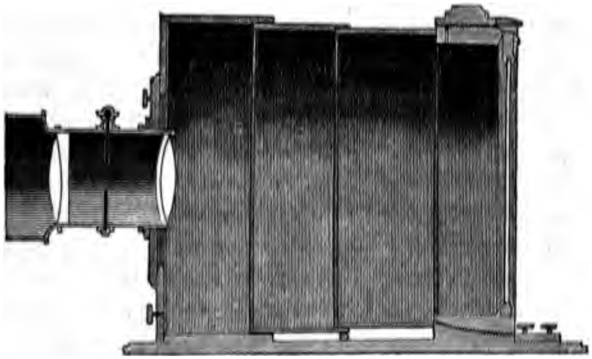
Its qualities recapitulated. To recapitulate. We find in the eye the following qualities—an aperture of such limited area, that for all practical purposes it may be considered a *point*—power of increasing or diminishing the quantity of light admitted to the retina, and, in proportion as the objects inspected are more or less distant, admitting the parallel, or suppressing those oblique pencils which would interfere with the absolute perfection of the image—of arranging the lenses in such a manner as shall give correct focus to objects at varying distances—the whole of the above being altered simultaneously, instantaneously, and in those nice gradations of proportion which the harmonious balance of the different qualities requires. Lastly, that the delineating rays arrive at *the curved surface of the retina* in the precise ratio of their lengths.

The camera our means of imitation. In the camera the lenses take the place of the aqueous humour and crystalline lens; by a strange perversity the diaphragm, which, performing the function of the iris and pupil, should have been placed between the pairs of lenses, used to be applied in front of them, to the manifest injury of the picture.

Diaphragm long incorrectly applied.

The rays refracted from the lenses are received on the ground glass, which is the retina of the camera. THE EYE. Ground glass screen;

Fig. 5.



We will now consider what are the qualities possessed by the picture given by the camera, and in what it most essentially differs from that which must be the object of our imitation—*nature, as seen by the human eye.*

In delineating on a plane surface, by means of lenses, the appearance of objects, we labour under many disadvantages, which rapidly multiply as we increase the size of the picture. This does not apply so much to representations of distant and inanimate forms, since with them the parallelism of the rays is greater, their reflecting surfaces are incomparably larger, they may be taken under any condition of light up to the direct sun ray, and as they are immoveable, the diminution of aperture and consequent time of exposure is of no importance; so that we may pass from

difficulties of its *plane* surface.

Still life.

THE EYE. the consideration of that class of subjects to those in which the difficulties to be surmounted are Living subjects. greater—namely, in the treatmeat of near and living objects by the double combination lens. In proportion as we approach the person to be depicted, **what is called *distortion*** in the image in- The action of the camera; creases; **that is to say, the focal** depth in the subject **diminishes**, consequently all projecting portions become enlarged, and as **the obliquity** of the lateral rays becomes greater the nearer we advance, in order to maintain satisfactory quality in the picture, it is necessary to do precisely what is done in the human eye in such circumstances, namely, to diminish the aperture in proportion to our advance, by changing the diaphragm for one smaller in diameter.

But in the camera we labour under two dis- its disadvantages, advantages in all this—namely, that in proportion as we approach the subject the focal length between the lens and the ground glass is rapidly increasing, and as we diminish aperture we subtract light, both which add materially to the time necessary to impress an action on the compared with the eye. film; besides these disadvantages, there is that imposed on us by the requirements of the art—namely, the necessity we are under of receiving the rays forming the image on a *plane* surface, the consequence of which is that those rays which, if received on a curved line corresponding to their length as in the retina of the eye, would have been as perfect in their form as the more central Action of rays on a curved and flat surface. ones, become distorted by the manner in which their terminations are widened and obliqued by

the mode of their impingement, as shown at C C fig. 6; and, moreover, as their focal length was THE EYE.

Fig. 6.

at B, D, B, it would manifestly be damaging to the picture to retain their confusing influences: in such case we must therefore submit to one of two things, an inferior quality of picture or an increased time of exposure. Lateral rays defective.

Since the publication of the first edition of this book, Mr. Sutton has invented and brought before the public a most ingenious form of lens, called by him the "Panoramic Lens," the pencils

THE EYE. refracted from which are received on glasses ot an appropriate curve. It is to be regretted that a condition which, amongst others, constitutes a portion of the merit of originality in a scientific invention, should oppose an obstacle to the more general use and appreciation of it, which so clever a combination as this lens well merits.

Apertures in the camera; In the camera great rapidity of action can only be obtained by large apertures and short focal lengths; in the eye we see that the pupil is a and in the eye; mere point, yet even the instantaneous action of the electric spark perfectly suffices to depict objects on the retina. If in the camera large apertures are used, the picture will be most incorrect, and entirely unlike the same object as effect of their diversity seen by the eye, a simple proof of which is the following:

Take a lens six or eight inches in diameter, and covering all its surface except an inch on one of its sides, take a picture with that portion of it; and errors of larger apertures; now reversing the operation, take another with

Fig. 7.

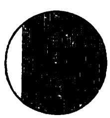
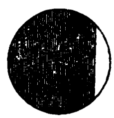


Fig. 8.



one inch of the opposite margin; print the two on thin paper, oil them, and superpose the prints; no two lines in them will correspond; they have been taken from two points of sight distant six their results or eight inches from each other; and yet, although these two pictures are so wanting in uni-

formity of lines, a portrait taken with such a lens at full aperture would be much more defective, since not only two portions of its margin, but the whole of its surface, would have been looking *round* not *at* every feature and every form in the subject—in fact, it would not be a picture of a lion, but a representation of his extended hide. It thus appears that when the representations of near living objects are executed, moderate sizes must alone be attempted, which may be increased in proportion as the camera is retired from the subject, and as the reflexive area of it is augmented. The use of medium sizes of lenses, which will in their action permit a balance of disadvantageous qualities, is desirable, until the time arrives, if ever it should, when the apparently irreconcilable conditions are united in the lens, which will enable the operator, with a *small aperture*, to cover a fair *extent of surface*, and to produce an image *perfect in drawing with rapidity*. In the mean time the photographer who aims at a successful result in this class of subjects, will do well to bestow all his attention in endeavouring to assimilate, as much as possible, the action of the camera to that of the eye, as it is by the unerring and practised comparison of the latter his pictures will be judged.

THE EYE. On portraiture. Moderate apertures recommended. Optical difficulties. Necessity of appreciating the two conditions.

LENSES.

Although the *construction* of lenses is the more immediate concern of the optician, the skilful *application* of them to their different uses is en-

LENSES. Application by the photographer:

LENSES. tirely the province of the photographer; and his pictures will be dependant, for many of their qualities, upon his perfect knowledge or otherwise of the extent of the capabilities and nature of action of his lens.

their importance in the process; The lens is the object of primary importance in his apparatus; it is at once an *atmosphere*, with novel conditions, through which he invisages nature; and the rays refracted from it are the *pencils* with which he delineates his picture. If it be the result if defective; defective in its qualities, no matter what dexterity, neatness of manipulation, or artistic knowledge he possess, it will be utterly impossible for him to produce a *perfect* photograph. Yet the "Portrait-lenses" made even by the most skilful optheir capabilities; ticians leave much to be desired: the smaller diameters, it is true, are sufficiently deep in focus, rapid in action, and vigorous in intensity on the glass, and definition in the picture; but the negatives they are capable of producing are very limited in size, and in proportion as the operator defects, increases the dimensions of his picture, and is consequently obliged to use larger and larger lenses, his difficulties, in this direction alone, multiply in an enormously increased ratio, until the time necessary to produce a picture is so prolonged as to put a veto upon subjects *from the life* being undertaken at all.

The qualities of a lens are governed by two and nature; leading principles,—the nature of the refraction possessed by the media composing it, and the forms which are given to their surfaces. Lenses are generally made of glass, but can be composed

of any transparent non-crystallized medium, provided that one or both the bounding surfaces are more or less curved. **Lenses.**

Lenses may be divided into two classes,—the *converging* and *diverging*, according as the nature of the action of their curves upon parallel rays of light is to gather them to a point, termed the *focus*, as the double convex (fig. 9), or to scatter them, as the double concave (fig. 10). **their action on parallel rays;**

Fig. 9.

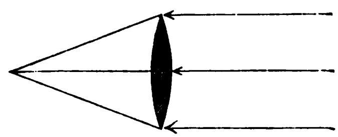
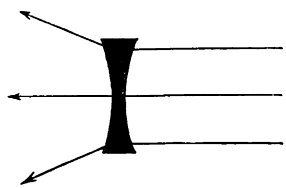


Fig. 10.



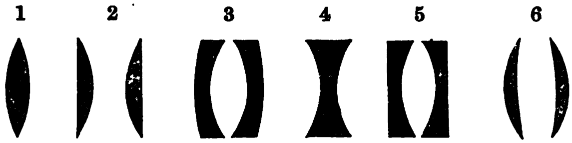
The action of a lens may be seen *drawn in the air* by itself, in the following manner: Paste on the lens a dark paper, pierced with holes, symmetrically arranged; make an orifice in a shutter facing the sun, place the lens in it; the nature of its action on parallel rays will at once become visible. **seen in the air.**

Advantage is taken by the optician in the scientific adaptation of varying degrees of curved surfaces, to antagonise the distortion in the form of the image, which, were such combinations not made, would appear; the result of these being, when skilfully effected, to reduce the "*spherical aberration*" to a minimum. **Science of optics.**

There are several forms of lenses, each of which **Dioptrics.**

LENSES. gives a different quality of direction to the incident ray. They are—

Fig. 11.



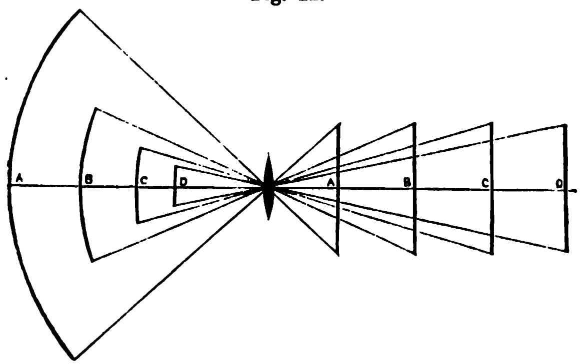
1. Double convex.
2. Plano-convex.
3. Concavo-convex.
4. Double concave.
5. Plano-concave.
6. Meniscus.

Eye and lens, difference in action. It has been shown, in the section on the Eye, that one of the greatest disadvantages we labour under in our imitation of its action, is the necessity imposed on us of receiving the image on a *plane* surface, whereas the retina is curved. The efforts of the first mathematicians have been directed to the study of the best arrangement of surfaces which the lenses should possess to neutralize this damaging condition; and their calculations, and the skill of the leading opticians of Europe, have, to a certain extent, been successful. Spherical aberration, Still, however well a lens may have been "corrected for spherical aberration," it is always a quality which, in proportion as we use the whole of the diameter of the Portrait lens or how increased; advance nearer the sitter or the object delineated, makes itself more and more felt, and requires all the tact and skill of the operator to remedy as much as possible; the means of doing so being how diminished. by judicious adaptation of diameter of aperture to the conditions above named, and will be treated of under the head of DIAPHRAGMS.

When light strikes in an oblique direction on a transparent medium, the beam is diverged from

LENSES.

Fig. 12.*



the direction it was pursuing more or less according to the refractive power it encounters in its passage, which differs considerably in all such media as the diamond, glass, water, oil, spirits, air, vapours, &c. The nature of the refraction of rays of oblique incidence may be seen on looking from above at an oar in clear water, or by allowing a minute sun-ray to pass through a hole and receiving it in a vessel of water, the change of direction on its entering the fluid from air will be distinctly perceptible. In addition to this change in its course, its incidence in the above conditions has dispersed or divided the beam into its coloured

Refraction of light.

Nature of media.

Dispersion of light.

* The dimensions of this work would not allow the diagram to be drawn on a larger scale. In order, therefore, better to mark the differences caused in the *lines* of the *pictures*, the relative size of the *object* taken was diminished,—it suffices to show its change of position.

LENSES. components; the effect of this in lenses would be, if uncorrected, that each object would be seen surrounded by coloured fringes, but as the refracting powers of flint glass and crown glass differ considerably, the dispersed rays refracted from the one are re-united in their passage through the other, "*achromatism*" results, and the coloured fringes disappear.

Achromatism.

This is the case in telescopes, microscopes, &c.; but as their application is intended for *vision* alone, it is only necessary that their lenses should be "corrected for colour" to such a point as to recombine the rays which form the image to the *eye*. But the photographic lens differs from these in this important particular, that it is not addressed to our sight, but to *chemical action* on the film, part of which resides in a portion of the spectrum invisible to the unassisted vision. Not to include them has no effect on the perfection of the image in a telescope; to neglect including them *all* in the photographic lens, corrected for coincidence of foci, is to retard and confuse its action in the proportion in which more or less of them may have been omitted.

Telescopes and microscopes.

The photographic lens; corrected for coincident foci.

In practice it is found that a lens not coincident in its foci requires "turning out" more in proportion as it is approached to the sitter, or as the entire aperture is used; and, that, as it is withdrawn, or its aperture diminished, the difference between the visual and chemical foci is less till at a certain point in either direction—of distance or aperture—the two foci coincide.

Treatment of lens when not coincident.

The reason of this is that the obliquity of the

lateral rays diminishes, and they become more parallel and less dispersed as we retire, or by excising them by diaphragms they are excluded, and the picture being relieved from their confusing influence, is depicted by the action of the central rays alone, which pass through the lens in a more homogeneous state of colour and unity of focus. The same action is sensibly felt in lenses coincident in both foci, although to an infinitely less extent.

LENSES.

Action of lateral rays;

and of parallel.

On portrait lenses.

This is only according to the primary law of light, which passes unchanged through a refracting medium, which it enters at a right angle, but which is more or less dispersed in proportion to the obliquity of its incidence. And, indeed, the principle extends beyond the mere instrument; the very atmosphere surrounding us is every instant—from sunrise to sunset—acted upon in the same manner. This it is that gives the greatest photogenic quality to the vertical *white* beam of the midday sun, which, as he descends towards the horizon, diminishes in proportion as his rays, refracting obliquely through our atmosphere, disperse and colour more and more as he recedes from the zenith, until in the vivid *reds* and *yellows* of his setting glory he disappears.

Action on our atmosphere.

Its effects

The most gorgeous sunsets in the world are proverbially the autumn sunsets of Venice, the contemplation of which probably went far towards creating in her painters the appreciation of that harmony in colour which rendered them the first colourists the world has ever seen.

The writer has constantly watched the whole

remarkably exemplified.

LENSES. Sunsets at Venice; range of the tints of the spectrum displayed in Venetian sunset skies, from the lavender and violet at the zenith, passing through blue, green, yellow, red, down to intense crimson, at the horizon.

The prism dispersing this colossal spectrum—in which our matchless Turner continually revelled—was the evening mist rising from the low marshy ground lining the Brenta, dispersing the declining and oblique rays of the setting sun.

In England; In our own country, under precisely the same conditions, the same results, though in a less marked degree, are seen. At Margate the autumn sunsets are very fine; the exhalations from the Essex marshes here play the part which those of the low ground towards Padua do at Venice, in dispersing and colouring the sun's rays; which, of course, at that precise moment, to those more to the westward, are vertical, undispersed, white and actinic.

the meridian light affected. So when some sudden change takes place in the actinic power—as is constantly proved by the action in the camera without our being visually conscious of it—the nature of the light, as emitted from its source, the sun, remains the same, but within our atmosphere, by the passing clouds or vapours near the earth, its beams are obliquely reflected or refracted, and for the moment dispersed in rays more or less coloured and unfitted for our purpose; the cause removed, actinism returns.

Varieties of lenses. The recent photographic lens varies greatly in its construction and dimensions according to the uses for which it is intended.

Formerly there were only two qualities of photographic lenses to choose from, whatever might be the nature of the intended representation; the double combination, or "portrait," and the single or "landscape" lens. There have been since invented the following varieties—Petzval's orthoscopic; Dallmeyer's triplet and wide angle landscape; Ross's doublets; Dallmeyer's new portrait, wide-angle and rapid rectilinears; all these possess a great variety of qualifications, and are each more especially adapted to the varied treatment of different subjects. In order to enable the reader to form a correct judgment thereon it will be necessary to describe their nature and practical working qualities at considerable length, and it is hoped that the information may save the student much useless expense and disappointment in his selection of an instrument.

LENSES. Recent inventions; their denominations.

Lenses are either "*single, double,* or *triple combinations.*" The first are intended for pictures of inanimate objects, in the treatment of which the time of exposure is of less importance. Their focal length is greater than the double, consequently, at the same diameters, larger pictures are obtained. "*Double combinations*" differ from them in having a second pair of lenses behind the first pair, which, intercepting the rays refracted from them, causes them to focus at about half their former distance, whereby the action is accelerated, whilst at the same time the curves of the back pair—or pairs, in the triplet—are so combined as to diminish or antagonise the obliquity of the rays passing from the front; thus

The single; the double combinations, accelerate the action,

LENSES. the pencils are relieved from the confusion consequent upon dispersion and spherical aberration —both, as has been shown, attributable to defective parallelism—and thus purified in their action the image they impress is more delicate in its definition and rotund in the appearance of the forms delineated; whilst under these conditions of double correction the aperture which can be used is in the "portrait lens" of much larger diameter than would have been possible with the front pair only, and the action which—to impress the same image—would have necessitated an exposure of sixty seconds, is accelerated, and ten or twenty suffice.

refine the image.

Comparative rapidity.

Qualities arising from various sizes.

The peculiar differences arising between various sizes and combinations, apart from the perfection of their construction, are *dimension* of resulting picture, *time* required to execute it, *depth of focus* in the subject, and *quality of definition* in the finished work; all of which vary considerably according to the nature of the combination.

Dimension of the picture.

The *dimension* of the picture arises from the focal length of the lens, and with the same diameter, is greater as it increases, and less as it diminishes; it is also increased or diminished according as the lens used concentrates and *diminishes* the pencils refracted from it, as the double convex; or spreads and *enlarges* them, as the double concave. *See ante page* 32.

Rapidity.

The *time* of execution—apart from the quality of illumination on the subject—depends upon the area of aperture, compared with the greater or less focal distance from the lens to the film.

Depth of focus in the subject is a most important quality, which diminishes in the ratio that the length of focus in the camera is increased, or that, with the same length of focus, the aperture of the diaphragm is allowed to remain injudiciously large. It is more or less perfect in proportion as, in the picture, more or less objects both before and behind the principal *point* of focus are included in clear definition.

LENSES. Depth of focus.

Quality of definition arises from several causes. Unskilful chromatic correction by the optician will cause the rays to overlap one another and confuse the image; excess of spherical aberration will give a lens in which the centre and margins cannot be in simultaneous focus.

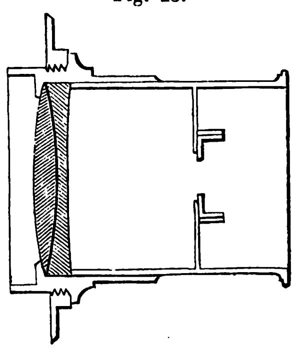
Definition. Fault with the optician;

Want of skill in the operator, in approaching nearer his model, and not cutting off the lateral rays, gives distortion and confused definition; size of picture attempted, compared with the reflexive area of the subject, gives a weak image.

with the operator.

THE SINGLE or LANDSCAPE LENS (fig. 13) is the most simple form of lens employed in photography; it is a "meniscus" composed of two lenses, one convergent, the other divergent, cemented together so that it presents only two surfaces to the loss of light by reflexion. It is well calculated for

Fig. 13.



LENSES. Single lens, out-door subjects, more especially those sun-illumined; the writer has, however, applied the single lens to figure compositions and groups in the glass studio with a north light. The charac- its qualities. teristics of the work of the single lens so applied are less vigour and rotundity in the forms depicted than would have been given by the double or portrait combination, but, on the other hand, there appears a depth of focus in the picture which, with the double lens, unless much stopped down, is difficult of attainment.

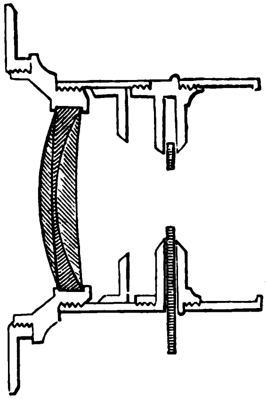
Groups in studio. It would not do to attempt larger sizes than 12 × 10 from the life with the single lens under the above conditions; indeed, the writer subsequently always uses the double, from small up to large diameters, for such purposes. He merely quotes this experience to show that from *large surfaces*, such as a group of several figures, &c., offering considerable reflexion of light to the lens, such treatment is possible.

Qualities for outdoors. For exterior work it does not give such rotundity of form from architectural originals as the orthoscopic, nor does it give the finish and delicacy that the triplet shows from any originals, but for subjects of foliage, of large or medium sizes, its qualities are better than those of either; since its greater depth of focus, and its having but two reflexive surfaces, enables it to work into the recalcitrant green of the landscape more completely and vigorously.

Dallmeyer's new landscape; Fig. 14 represents Mr. Dallmeyer's new single combination landscape lens. It is composed of three lenses, two of which are crown and menisci

made of glass possessing different optical proper- LENSES.
ties, and between them its elements;
is placed a concavo-convex flint glass lens—the three are cemented together, thus in effect a single combination—and externally a deep meniscus. The diaphragm is placed nearer to the lens than in the old form of single lens; hence the new lens embraces a much larger angle of view, 90°, with less distortion of the marginals.

Fig. 14.



By the employment of *two* kinds of crown glass, possessing different refractive and dispersive powers, as well by their forms, the chromatic aberration of the *excentrical* pencils is more perfectly corrected; hence this lens admits of the use of larger stops than the earlier form; its action is therefore more rapid, and its work more finished. qualities described;

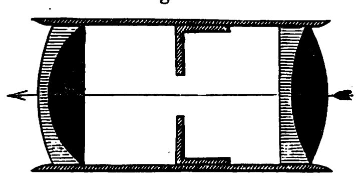
The single lens is not free from distortion, the marginals belly out, the direct converse of the "Orthoscopic," and give what is termed the "barrel shaped" figure to the image from a square original. distortion of image. For landscapes this is practically of no consequence. For representations of objects of still-life, at sizes approaching the originals, no lens can at all compete with the single. Groups

LENSES. of game, birds, &c., have been taken by the writer at two thirds the natural dimensions in 90 seconds to three minutes, north light in the studio.

Portrait lens, The "PORTRAIT LENS," being intended to produce pictures from the life, is by far the most important and, in a great variety of ways, the most useful of all optical photographic combinations. The qualities it is most requisite for it to possess are rapidity, depth of focus and definition, combining as many of these qualities as is possible with (desirable qualities;) its diameter and focal length; for, as will be shown, the enlargement of the former and prolongation of the latter are inconsistent with the possession of the first three in their full perfection. So (the first used in England;) that in selecting a portrait lens the purchaser must be guided by the nature of the pictures it is chiefly intended to produce.

That eminent optician the late Andrew Ross constructed in 1841, for Mr. Collen, the miniature painter, the *first* portrait lens (fig. 15) used in this (description of;) country; the following is a brief description of it. A crown glass of unequal convex curves cemented to a plano-concave flint; a plano-convex crown cemented to a convexo-concave flint. The lenses are $3\frac{1}{2}$ inches diameter, 8 (its dimension) inches back focus; it is for 5-4 plates.

Fig. 15.

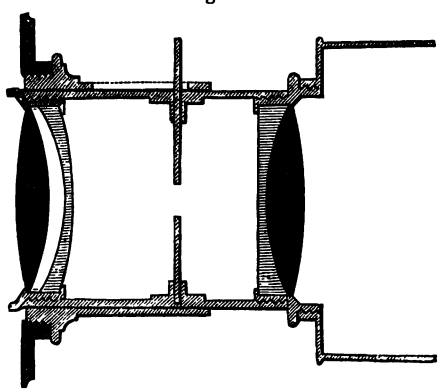


Both the lens itself and some of the portraits

taken with it have recently been shown publicly, and, although it differs from the form since generally adopted, its optical elements are very meritorious, and the portraits taken by it were considered, even with our present advanced means of different kinds, as not only interesting—being the first examples of photo-portraiture in this country—but possessing considerable intrinsic excellence. LENSES. and qualities.

The portrait lens now in general use was first constructed from calculations made by Professor Petzval of Vienna; its optical components are a front crown lens of unequal convex curves, to which are cemented a double flint lens of unequal Petzval's portrait;

Fig. 16.



concave curves; the back combination is a crown lens of unequal convex curves and a concavo-convex flint lens at a little distance from it. For more than a quarter of a century this lens, without further change in its construction than modifi- long used;

LENSES. cations of its curves, has been used not only for the class of pictures its name denotes but for a variety of others. Latterly Mr. Thomas Ross has succeeded, by a modification of the curves, in flattening the field and shortening the length of focus with consequent increase of rapidity.

improvements; their nature.

Diaphragms. For several years after the production of this lens the diaphragms were always placed only *in front* of the combinations. The writer proposed and carried out the alteration in its position from the front to the middle, since which time it has, by all the first opticians, been so continued.

Defects. There is in the portrait lens a curvature more or less considerable of the field, which renders the definition of its marginal pencils weak and enlarged compared with the central ones. There has always existed, in the larger diameters especially, a shallowness of focal depth in the pictures given by it; reclamations were continually made to the opticians with a view of obtaining more depth of correct focus and good drawing: the reply always was that it was an impossibility, and the operator had to fall back on diminution of aperture, at the cost of rapidity of action, if he insisted on correct drawing. Mr. Dallmeyer has been the first to improve upon the original portrait combination, and in his new portrait lens he has most ingeniously succeeded in obtaining a diffusion of focus, at the will of the operator, by increasing the space between the posterior pair of the combination; the effect of which is to give a general fleshy softness in lieu of the shallow line of excessive and wiry definition, quite unnatural in

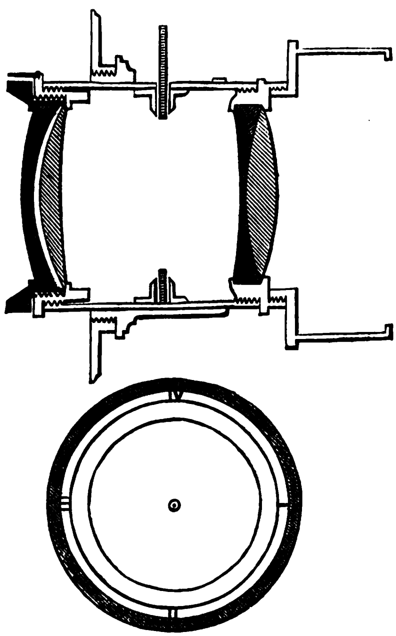
Deficiency in depth of focus.

Dallmeyer's new lens.

its character, and which was always in juxtaposition—in very large heads especially—with buzzy outlines, enlarged features, and hairs like black lead pencils. LENSES.

Fig. 17 is a section of Mr. Dallmeyer's new Optical elements.

Fig. 17.



portrait lens. It consists of two actinic combinations; the front resembles that of the Petzval lens, the back, however, differs essentially from it not only as regards the ratio of radii of the lenses employed, the crown being a deep meniscus and

LENSES. the flint a deep concavo-convex, with their adjacent surfaces dissimilar, but their positions are also reversed, *i. e.* the concavo-convex, or flint glass lens occupies the external position, instead of the internal as in the Petzval, and this flint lens being mounted in a cell capable of being unscrewed, affords the means of regulating the spherical aberrations of the entire system at will, as we will now proceed to explain. If the reader refers to Fig. 16, the original Petzval, he will there observe that the concavo-convex flint, or negative lens of the back combination, occupies a position next in order to the front combination; the rays of light refracted by this converge upon the flint glass lens, and, after refraction here, they emerge nearly *parallel* and in this condition they arrive at the posterior crown glass lens. It will be observed, therefore, that any alteration of position as regards the distance of this crown lens from theflint cannot, and does not, affect in any sensible degree the correction of the central spherical aberration of the entire system. Referring now to the section representing Mr. Dallmeyer's new portrait lens we perceive the case is very different, he having transposed the position of the respective lenses of the back combinations. The rays of light, after refraction by the front combination, are in his lens converging upon the crown glass or positive lens, and, after refraction here, instead of being in a condition of parallelism, they are strongly *converging* towards the axis until they arrive at the concave surface of the posterior flint glass lens. This being a negative or diverging lens

Altered at will of operator; the manner explained; construction described. Focus prolonged.

acts in a contrary direction and prevents the rays from rapidly converging, in other words prolongs the focus. It is obvious, then, that any alteration of distance or separation between the pair of back lenses composing Mr. Dallmeyer's lens, at once shortens or prolongs the focus of the whole system, in other words alters the effective diameter of the posterior flint glass lens; and the corrective influence of this being proportionate to the diameter of it actually *used*, it is clear that, if the lens as a whole has its spherical aberrations balanced when the posterior lens is screwed home, a small amount of separation, by unscrewing—*i. e.* reduction of the effective diameter of the correcting flint glass or negative lens—will produce positive spherical aberration for the whole system, and this proportionate in quantity to the amount of unscrewing, or separation, of the posterior lens.

The lens intact; its components separated.

The lower portion of the diagram exhibits a plan of the "mount" or cell of posterior flint glass lens. This cell containing the lens admits of being unscrewed one or more or *parts* of revolution of screw; the amount being registered by an index and divisions. With the posterior lens of the back combination screwed "home" Mr. Dallmeyer's lens possesses all the good qualities of the old form of portrait lens, as regards the perfect correction of the spherical and chromatic aberration of the central pencils; the oblique rays are even more perfectly corrected, consequently the field is somewhat flatter and the illumination extends more evenly towards the margins of the picture.

The manner. Its qualities

LENSES. The writer has tested this lens side by side in the same camera, from the same subject, on the same film, and finds that when *intact* the lens is as rapid and its definition precisely equals that of a corresponding diameter, and length of focus of the Petzval form, by the same optician, tried by its side. Various applications and exposures were tried, the final and crucial test applied being an *instantaneous exposure* when the shortcomings, if any, of either lens would at once have been made most palpable, either by the field not being covered, the definition of objects in different planes being defective, or one or other picture being more intense than its twin. There are no signs of distortion of margins, and when worked with the smallest diaphragm there is no "flare" or central spot.

practically tested; the results.

When the posterior lens is *unscrewed* the objective at once gains in penetrating power or defining objects situated in different planes, at the same time losing that intense sharpness of definition before present on one plane only. The marginal definition remains good in the same relative proportion, and there is no other drawback.

Its peculiar characteristic;

The many uses of this new instrument are obvious, especially for large pictures, heads, compositions, &c.; it confers a new power on the Artist photographer to be used at his discretion.

how applicable.

"Portrait lenses" are constructed of three distinct classes, according to the desiderata of their proposed employment. The first class are lenses of large diameter and aperture compared to their short focal length—here the greatest *rapidity* is obtained, at sacrifice, however, of flatness of field

Different qualities

which has considerable curvature. The middle class are lenses of equal diameter and aperture as the last, with about double their focal length; thus, $3\frac{1}{4}$ diameter, 6 inches focus in the former, becomes $3\frac{1}{4}$ diameter, 10 inches focus, and *for general use these are the best compromises* between antagonistic conditions; they are less rapid, but flatter in the field, and cover more space with less aberration and distortion. The last class are "long focus" lenses, which, at the same diameter—3 inches—have about 15 inches focal length, the result of which is that the field covered is larger, flatter, and the marginal pencils are more incisive, or the film, but from small reflexive surfaces, as a single head, they are necessarily *slow*. They are, however, well calculated for groups, can be used for reproductions, &c.; as, in the first, the larger reflexive area tends to give more rapidity, whilst for the latter a flat picture of some size is obtained with a comparatively large aperture.

LENSES. Of Portrait lenses. "Long focus;" their uses.

From the large exposed surface of the front pair of the "portrait lens," the photographer who desires clear bright pictures *cannot be too careful, even in the studio,* of course still more so in the open air, to shield this lens *in every possible way,* from the action of diffused light on its surfaces.

Cautions.

THE ORTHOSCOPIC LENS.—This lens, fig. 18, was constructed upon calculations made by Professor Petzval of Vienna, long subsequently to the production by him of the portrait combination, and its name imports that, by its action, true drawing and absence of distortion would be given. This is not exactly correct, since the lens has a distor-

Qualities of

LENSES.

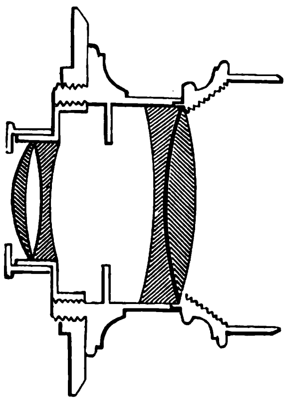
the Orthoscopic lens.

tion of its marginal pencils, but in a precisely opposite direction to that of the landscape lens, *i.e.*, the orthoscopic gives inward curves, or an "hour-glass"-formed image to the marginals: notwithstanding which this lens has excellent qualities.

Description of.

The following are its components as constructed by Voigtländer. The front combination consists of a double convex crown cemented to a bi-concave flint lens, forming an achromatic meniscus. The posterior combination consists of a bi-concave flint with a convergent meniscus of crown. The surfaces of this pair are necessarily separate from each other. Diaphragms for this lens are placed by Voigtländer *behind* the whole system. It is the opinion of the writer that *for this lens* this is the correct position; the posterior lens being divergent should receive the impact of the entire action of the front combination and not with its light and pencils restricted, which is the case when the diaphragm is placed between the lenses as has subsequently been done by many opticians. This is advanced on a considerable practical acquaintance with this lens constructed on both methods.

Fig. 18.



Diaphragms differently placed.

The sizes requisite to cover large plates, 18 × 14, are of small bulk: it is eminently calculated for large groups in the open air; since, for this use, it has more intensity of definition and rapidity of action than the single or landscape lens; though not so rapid as the portrait, its marginal pencils have more power and incidence on the film, consequently the definition of the entire subject is more complete at the edges of the picture. It has also more depth of focus than the latter.

LENSES. Its powers compared with other lenses;

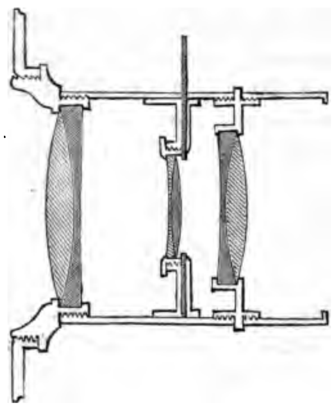
The writer, in one of his journeys to Italy, took six of these lenses of various sizes, half of the number by Voigtländer, the remainder by Ross, between whose construction of them he did not perceive any difference; he put them all to a variety of uses; views in cities from 18 × 14 downwards, large groups of many figures at the same dimensions, as well as smaller sizes were executed by its means. One condition must, with this lens, receive the most careful attention of the operator; namely, that when it is used out of doors, the front pair of the combination being large and exposed, by means of a diaphragmed box or cone, or other sufficient means, it must be sedulously shielded from the action of diffused light or fogged pictures will inevitably result. A common hat box blacked inside, with an oblong square opening of the form of the intended picture cut in the bottom may do good service of a temporary nature. An old Gibus hat, lined with cotton velvet, may be impressed for more permanent use; its folding into small compass being a great convenience to the travelling photographer.

practically tested; necessary precautions.

LENSES.

The Triplet Lens was first calculated and constructed by Mr. Dallmeyer; fig. 19 represents a section of it.

Fig. 19.



It is composed of three cemented combinations; the front and back are *positive* or converging lenses; between these two, dividing the space in the proportion of their foci or diameters, is situated the negative or diverging combination. This is also the place of the diaphragm; each of the three combinations is actinic.

Triplet described;

The front and back combinations placed in their respective positions at each end of the tube or "mount," viz., the smaller facing the subject and the larger the screen, without the negative lens but simply inserting the diaphragm, the lens produces an image free from distortion because the deflexion of the rays in *one* direction as caused by the front, is exactly neutralized by a deflexion in an *opposite* direction occasioned by the back combination; the result being that the emergent ray is *parallel* to the incident one, the condition necessary for the production of an image free from distortion.

freedom from distortion;

Thus, then, the front and back combinations in their respective positions produce an image free

from distortion. But the field of view is so much curved that, in this state, the lens is practically of little use. Now by introducing the negative combination in its position the correction for freedom from distortion does not become practically impaired, because its effect upon the pencils is *axial* and by virtue of its power of prolonging the lateral pencils it imparts to the otherwise comparatively useless lens the requisite amount of flatness of field.

effect of the central combination;

Mr. Dallmeyer has so arranged the diameter, forms, and foci, of the three combinations composing his triplet that the spherical aberration of the axial and lateral pencils are corrected for an aperture equalling $\frac{F}{10}$, it, therefore, takes rank among the aplanatic lenses, and for copying architecture, &c., it is a most valuable instrument, being, with the full opening, twice as rapid as the non-aplanatic or wide-angle lenses. It is eminently calculated for reproduction; a monster triplet, 8 inches diameter, 5 feet focal length was made by Mr. Dallmeyer for the Department of Science and Art, South Kensington, and, under the skilful treatment of the late Mr. Thurston Thompson, produced admirable results.

its aperture;

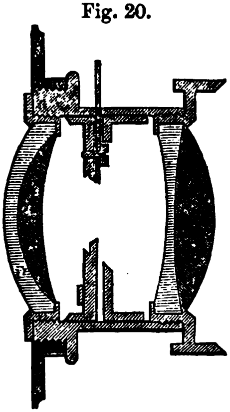
For delicacy and refinement of work, at all sizes—medium and *small* especially—no lens can compete with the triplet; its penetrating power is evinced by the manner in which, when *working away from the sun,* the clouds appear clearly defined in its instantaneous pictures. It is a lens which should be in the possession of every out-door photographer.

its excellences.

LENSES. Doublets;

ACTINIC DOUBLET.—This lens, fig. 20, the production of Mr. Thomas Ross, consists of a crossed

Fig. 20.



crown lens cemented to its correcting flint lens, which is a crossed concave, the whole forming a deep meniscus, the focus of which is equal to that of the back combination, or about double that of the equivalent focus of the complete instrument. The posterior meniscus combination consists of a meniscus

their elements;

crown lens cemented to a concavo-convex flint lens, the two combinations are mounted in a rigid brass setting with a rotating disk of diaphragms placed midway between the lenses.

Previously to the invention of this lens, representation by photography of many most interesting subjects had to be very unsatisfactorily given or relinquished altogether. The artist can include in his sketch whatever objects present themselves to his sight: not so the photographer—splendid

desirable peculiarities

subjects in the confined gorges of Alpine passes, interesting Interiors, but of limited dimensions, picturesque bits in the narrow Gothic streets of Rouen, Nuremberg, &c., and in fact all subjects of comparatively confined angle of view were formerly incompatible with the exigences of the

described.

camera, but can now be perfectly rendered. Being

a double combination its work is much more finished, intense and rotund than the single lens, but its great peculiarities are the large angle of subject included in its representations, and its straight marginal lines; which, when working from architectural originals, or in copying, cannot be over valued, and above all absolute freedom from "flare." LENSES.

This lens is constructed with three differing angles of aperture, the largest, with smallest stop, defining perfectly over a circular field of 95° in diameter; the ordinary angle over 74°, and the small angle over 50° to meet the various exigences of its proposed employment. Its varieties

It has been made of very various dimensions, the largest for the Belgian Government for copying purposes; diameter of lenses 8 inches, focus 48, for plates 50—42, down to a diameter of 1 inch, with a focal length of 4. It is an indispensable instrument to every photographer of subjects other than portraiture. and dimensions.

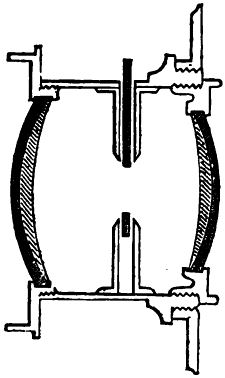
WIDE ANGLE RECTILINEAR.—Fig. 21 represents, in section, this lens as constructed by Mr. Dallmeyer. It consists of two cemented combinations, each composed of a deep meniscus crown and a deep concavo-convex flint glass lens. Rectilinears

Unlike the usual position and method of achromatization the flint, or dense refracting medium, is made to occupy the *external* position in both combinations. They are both deep menisci externally, of nearly the same focal lengths, the front being of larger diameter and greater curvatures than the back combination. Between the position of its components;

LENSES. two, dividing the space in the proportion of their respective diameters is placed the revolving diaphragm, the largest aperture of which is $\frac{F}{15}$; the position of the stop being nearer the back combination avoids all traces of central spot or "flare."

its aperture,

Fig. 21.



This lens embraces a very wide angle of view—90° to 100°. It is quite free from distortion, and although not an aplanatic lens, in the usual acceptation of the term, yet by the peculiar mode of achromatization, positions and radii of curvatures of the lenses employed, Mr. Dallmeyer has succeeded with small diameters in covering relatively large surfaces; and since the aberration of a lens increases with its thickness, or diameter, the above must be considered an important characteristic of this lens.

and qualities.

Injudicious employment of wide angles

At the same time that the possession of "wide angle" lenses is recommended as *indispensable* in the varied treatment of out-door subjects, the student is cautioned against the *constant*, or promiscuous application of them, when ample space offers itself to take buildings, especially with the single, the orthoscopic, or the triplet, since the "wide angles" have a distinct tendency to exaggerate the linear perspective and enlarge foreground objects in the pictures given by them, thus unnaturally fal-

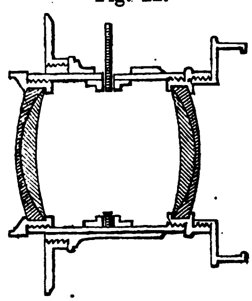
sifying the representations of well known localities. Also from the necessity existing for using small apertures of diaphragm they are not rapid lenses, and their employment must be judiciously timed accordingly. The writer has several sizes in his possession and finds that, with the smaller sizes especially, there is great power of including difficult laterals in the picture and that, even when extremely close to the camera, the straight lines of the subject are wonderfully maintained in their integrity in the photograph.

LENSES. deprecated; excellences described.

The principal uses of wide-angle lenses are those previously described, but for out-door quick pictures Mr. Dallmeyer has quite recently constructed a modification of his "wide-angle rectilinear" lens, which he calls his "Rapid rectilinear;" its construction is shown in fig. 22. The lenses composing the front and back combinations have the same general form as those of the former lens, but they are identical, and of smaller diameter; it being constructed for angles of picture of from 60° to 70° only. It has four times the rapidity of the rectilinear wide-angle—100°. In fact it is aplanatic and requires no stop to correct the central spherical aberration, the aperture being $\frac{F}{8}$. As compared with the triplet and

New lens; its construction

Fig. 22.



LENSES. orthoscopic lenses, with full opening, it is twice as rapid.

For copying to all sizes or scale this lens, being perfectly symmetrical, must be regarded as the most perfect lens extant; and, since it admits of the use of a larger aperture, it is well adapted also for badly lighted interiors, *where there is space for its use,* and for almost every purpose of out-door photography requiring short exposures and an angle not greater than that above cited. A lens of this construction has recently been sent to Vienna for purposes of copying in the governmental departments, who have forwarded to the maker an official recognition of its excellence. The writer possesses one of these lenses—just finished—his acquisition of it is too recent to enable him to speak practically of its merits applied to landscapes, groups, or architecture, for which it will, under skilful treatment, develope valuable qualities, but having copied with it he is enabled to speak most highly of its capabilities for that use;—it is a very remarkable instrument.

and qualities enumerated; its probable applications.

How to test a lens,

The test about to be described will enable the photographer to decide, at one and the same time, most of the qualities possessed by a lens.

At one end of the glass room construct, either with light wooden lathes, or strings drawn across between nails at *regular intervals* of some six, nine, or twelve inches, a figure of the nature of the one given below; it may be either upright, square, or oblong.

described.

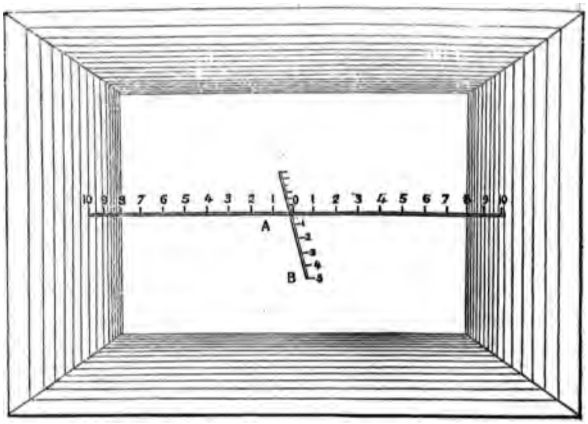
It will be well to suspend a large printed paper or poster between the points, 2, 2, on the central

parallel line, and immediately behind it a life-size bust; much of the rest of the space may be filled in with a variety of objects of still life, taking care, however, not to hide the numerals. Now place the camera precisely opposite to, and at a *right angle* with the centre of the subject, level it with a spirit level and fix it securely, use the *full aperture* of the lens, and focus very exactly on the centre at 0; take the picture, say

LENSES.

Position of camera.

Fig. 23.



in twenty seconds with a $4\frac{1}{2}$, in ten seconds with a $3\frac{1}{2}$ lens—accordiug to light—and develope it. If it is wished to compare a second or a third lens of the same size, unscrew the first and replace it with a second—should it not fit the same flange, it will be necessary to have a temporary front slide made in common deal,—refocus on *precisely* the same point in the subject; be as rapid as possible in manipulating, in order that the conditions of

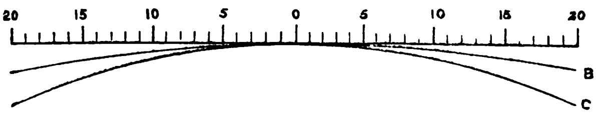
Comparing several lenses.

LENSES. light may not vary between the two pictures, take it exactly in the same time of exposure.

Definition. For clearness of definition look to the full aperture pictures, see especially how the printed sheet compares in each and the rest of the objects seriatim. Flatness of field is what the numerals on the long central line will more particularly decide; take the full aperture pictures and examine that line, see how far along it, from the central point *perfect*, or nearly perfect, definition of the numbers is maintained, and the figure at which in each it becomes defective, and you may find the difference of flatness of field as much as

Flatness of field. shown in the diagram,

Fig. 24.



and that consequently B is the lens which is flatter in the field than C, which would not only give it more correct drawing, but enable it to

Depth of focus, cover a larger surface. The *depth of focus* in the picture will at once be shown by the numerals on the staff at right angles with the lens; according as more or less of them are in focus from the central point 0 to 5, *front and back*, so is the action of the lens, in this particular, more or less perfect.

not sufficiently appreciated. In general, in testing a lens intended for portraiture, far too much stress is laid on its power of "copying a sheet of the 'Times!'" and

the much more important quality—to its purposes—of *depth of focus in the picture* is overlooked; the consequence is, that when a *portrait* is taken with such lenses, a shallow line of correct focus, through the figure and drapery, is in immediate contact with the most misty and distorted forms. Such lenses are excellent for copying oil paintings, &c.; they have a *large, flat* field, and, for such uses, the shallowness of their focal depth is of no consequence.

LENSES. The consequences. Special utility.

The quality "rapidity of action" is of such vital importance in selecting a portrait lens that a complete and correct comparison of two or several lenses to test their comparative excellence on this point becomes of great consequence.

Rapidity,

It is not sufficient that three or four lenses of the same or varying diameters, and with the same or different apertures, should be *consecutively* pointed at the same objects and the results compared. Light changes so quickly, and with such subtility, as often to the eye to present similar appearances when its actinism, in the camera, may have undergone considerable alteration.

mode of testing,

Thus, an experimental trial and comparison of—say four lenses—conducted consecutively has, not only during the time it lasts, which will be rather considerable, to contend with change of light, but also of the slightest variation in exciting or developing. The only real method of comparing their action is *simultaneously* to take with them, on one film, with identical treatment of every kind—four pictures. The writer has a front constructed, to this intent, to one of his

with great precision,

LENSES. large cameras which will receive four lenses of considerable diameter, and by means of elastic divisions between them, inside the camera, the image refracted from them is completely separated, although their focal lengths may differ considerably.

described. Now, on exposing one film to the combined, but divided, action of the whole, and subsequently developing identically, the most absolute and exact comparison for rapidity of action is established, which can, in no other manner, be accomplished.

General test. These modes of testing their qualities apply equally to all lenses, but, according to their construction, they have, at the same diameters, very various peculiarities which have been noticed in the previous pages.

DIAPHRAGMS.

Description of diaphragms. Diaphragms are metal plates perforated with a central aperture, ranging from half an inch up to nearly the full diameter of portrait lenses.

Their action explained. They increase the clear definition in the picture by their action on the marginal rays reducing the spherical aberration, and they add to the focal depth in the subject; but for every diminution of the diameter of aperture a corresponding reduction in the quantity of light which illuminates the collodion film takes place, and there is, therefore, with the portrait lenses especially, a limit in the decrease of aperture which should not

be exceeded, as otherwise the deposit of silver on the glass will be too weak and inefficient to print well; and as the time necessary to take the picture increases most rapidly *pro rata* as the size of aperture diminishes, the artist must be content, when operating from the life, to sacrifice some portion of *definition* in his picture, the better to secure a vivacity of expression in the countenance.

Judicious application of.

The photographer should arrange his sitter and inspect his subject at the *full aperture* of his lens; he not only has more light upon the subject in the camera, but the planes of perfect and of faulty focus are at once so defined that he is facilitated in improving the arrangement of his picture by advancing or retiring any portions of it. Having done this, he must now, according to the exigences of focus in the picture, and the quality that the light at the moment may happen to possess, arrange his area of aperture, on which, in fact, depends the definition and time of exposure of his picture.

Mode of applying.

Practice only will enable him to decide *on the instant* what aperture certain qualities of light, subject, and lens will require, and beyond which point it would be objectionable to reduce it; and the acquisition of this faculty is so necessary to the proper use of the lens, that I would advise the student to address himself diligently to the observation of the variations caused in the action of his lens by different applications of diaphragm; noting also the time of exposure, the conditions of light, temperature, bath, and collodion, under

Dependent on subject, &c.

DIAPHRAGMS. Importance.

which the picture was executed, which experience alone will make him master of the variety of effects consequent upon the manner of working the lens with *different apertures*, according to light, subject undertaken, and qualities desired to be obtained in the picture,—the importance of which study to a perfectly successful result cannot be better illustrated than by the fact that by skilful adaptation of his diaphragm one photographer shall, with an inferior lens, make a fair picture, whilst the inexperienced will utterly fail with the most perfect instrument that the optician can furnish.

Greatly improve even a bad lens.

Change of position.

The writer is glad to observe that the principle which he advocated and called into notice in the first edition of this book—pages 48, 49, and 50—of placing the diaphragm between and not in front of the portrait combination, as had, till that time, been customary, has now become universal, and that the manner of so placing the diaphragm, given at page 50 of the former edition, the brass work simplified by Mr. Waterhouse, facilitates the above purpose.

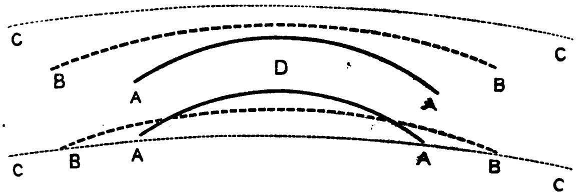
We will now examine the variations which are caused by the diminution of aperture, in order that the reader may clearly appreciate the differences between them.

Action of, illustrated.

The accompanying diagram will give the student a good idea of the action of the diaphragm on a Portrait Lens. The dark lines A A, represent the depth and direction of the focus of the lens at full aperture. The curvature of the field is purposely exaggerated in order better to show the

subsequent result. We will take the *full aperture* to be 4½ inches; it will be observed that in this condition the field is curved—which gives bad DIAPHRAGMS Full aperture;

Fig. 25.

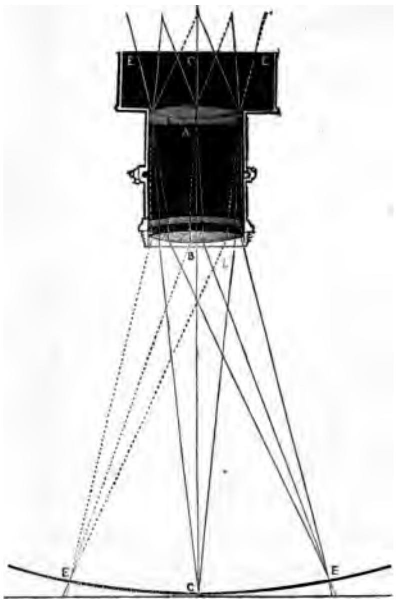


definition at the margins—that the depth of focus is limited, which gives enlargement and distortion to all projections, and that the size of the picture is small. Now on placing a diaphragm of three inches aperture between the combinations, the result is represented by the dotted lines B B; it is then seen that the field is extended and depth of focus increased both before and behind the central point D, the consequence of which is that a larger field of clear definition is shown in the picture, and features which before were buzzy and enlarged in their form, assume their natural aspect. partially reduced;

If to include more objects in the composition, or from other motives, still greater sharpness is desirable, a diaphragm of 1½-inch opening is substituted; immediately the qualities recapitulated above are still more improved as seen in the lines C C. Light has now, however, been much diminished by the small remaining area of aperture, and very considerable addition becomes necessary to the time of exposure. still more so.

DIAPHRAGMS Otherwise illustrated. Fig. 26 represents a section of a $4\frac{1}{2}$-inch double or portrait lens at its full aperture, with the manner in which the pencils of light from the subject pass through the combinations, and are refracted by them to the film. A is the front, B the back lens, C C the central rays, E E the lateral ones; E C E the line of focus at the film.

Fig. 26.



The attention of the reader must be directed to the *width* of the pencils refracted from the lens at this aperture, and the obliquity of the direc-

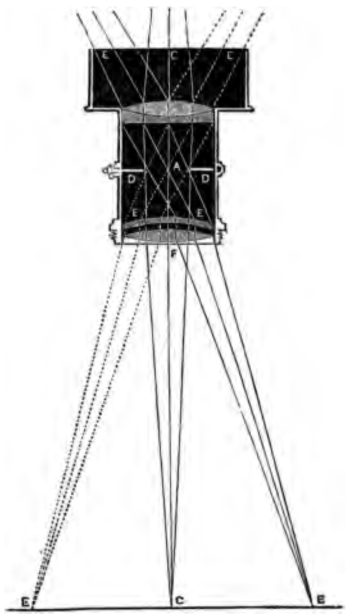
Conditions of. tion of the lateral ones (E E), in order that he may observe the changes which the application of a diaphragm will at once effect in them. Fig. 27 is the same lens with the pencils of light drawn to scale; a diaphragm (D D) of two inches aperture (A) is now added between the combinations, the effect of which has been to diminish the obliquity and give more parallelism to the rays proceeding to the film, and more depth in the

Altered by diaphragm. focus. On contrasting the width of the pencils

E E with those in the last diagram, they will be found to be diminished in their diameter by one half, with more accuracy of delineation, but at the loss of rapidity of execution by the abstraction of a corresponding illuminating area. The length of the focal distance from the back lens to the film is increased, but with a well-corrected lens of *"long focus,"* the field, under such conditions of aperture, is very nearly flat.

DIAPHRAGMS
The changes it causes.

Fig. 27.



Enough has been placed before the reader to show him that AREA OF APERTURE is the very helm which regulates and guides the photographic action; if too much diminished not only the time of exposure becomes irksome, and the expression of the sitter's countenance suffers, but a harsh and unnatural edginess characterises the picture. If, on the other hand, it was allowed to be too great, the oblique pencils, which it should have corrected, interfere with the perfection of the

Importance of area of aperture.

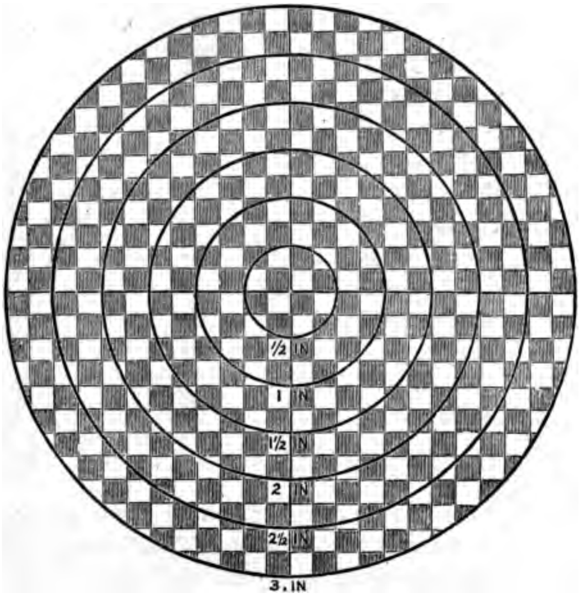
Decides the qualities of the picture.

DIAPHRAGMS image, and distorted forms and misty outlines are seen.

Result of neglecting it.

So that as *time of exposure* and *quality of definition* are entirely dependent upon the proper use of the DIAPHRAGM, the necessity of carefully studying its varying action will be apparent; and

Fig. 28.



so altering the size of aperture, as may be most appropriate to the circumstances of *light*, size of *reflexive area* of subject and *distance* of the lens from it, that not one pencil of light shall be suppressed which could contribute to forming the

Must be studied.

image correctly, nor any allowed to remain which, by their obliquity, would distort or confuse the picture. DIAPHRAGMS.

The accompanying scale will assist the student in comparing with sufficient precision, the difference of area from one sized diaphragm to another, and basing his calculations for time of exposure accordingly. Scale of different diameters.

PART II.

THE REQUISITE APPARATUS.

THE GLASS STUDIO.

GLASS STUDIO.

Necessary in portraiture;

IN taking portraits of any size, or arranging groups from the life, no good results can be obtained in Photography, unless they are executed in a glass room or studio, specially designed with regard to the requirements of the process, as the least wind deranges the hair of the sitters, and the ribbons, folds of draperies, &c., of their costume.

but diminishes light.

In other respects, the necessity is detrimental to the photographic action, since all glass gives a greenish tinge to objects placed under it. We have only to compare the faces of persons standing under the first railway station with those outside, to feel convinced that such is the case.

False principles;

Various fallacious and misleading instructions respecting the construction of the glass studio for portraiture have been advanced, and have doubtless induced many persons to make large outlays on buildings constructed on false principles. Indeed, the writer has himself taken portraits in the studios of amateurs and others which were most expensively fitted, and complete in every essential save the one most necessary, namely, that of giving the proper light on the sitter, and in that they were totally deficient.

consequent failures.

GLASS STUDIO. In the whole range of necessities for photographic portraiture there is no item on which success more depends than on the proper illumination of the face and person of the sitter; many of the hard overmarked exaggerations which horrify the sitter and the sitter's friends are entirely due to the injudicious angle at which the light is allowed to plumb down on his head. It cannot be too much urged on the reader's attention that the light illumining the face in *photographic* portraiture ought to be from rather a low angle, and that the top light should be tempered by white muslin or ground glass—not entirely cut off by actual opacity. Very recently attention has been called to the fact that many samples of glass, originally good, deteriorate photographically, by turning yellow, after having been for some time on the glazed roof of the studio. It is the opinion of one of our most talented opticians—whose vocation necessarily leads him to study its nature—that of all the various qualities of glass, none equal "hard crown" for remaining photographically unimpaired by time and exposure; it should have a bluey not greeny tinge.

Results.

Peculiarities of glass;

its best qualities.

The author has used in his studio, in the part immediately opposite the sitter, large panes of colourless plate glass with good effect. The St. Gobain, Cirey et Cie, Paul's Wharf, E.C., supply whiter plate glass than can be obtained of English manufacture. When *in situ* it is also highly requisite that it should be kept scrupulously clean, a point which is rarely, if ever, attended to. Thus the light cast on the sitter traverses a

Colourless plate.

GLASS STUDIO. villanous compound of concentrated coal smoke, and the victim, impaled on the head rest, is made to suffer double the requisite amount of "exposure."

Means of cleaning The writer has applied with success a simple means whereby cleanliness of the glazed roof, at the least trouble and outlay, is promoted, whilst, at the same time, the intense heat to which the glass studio is exposed during the summer months is greatly mitigated by evaporation from its surface. Carry along the ridge of the top a leaden or zinc pipe perforated with holes; it can either communicate direct with a cistern—above its level—and be made to act by turning a stop-cock, or can be connected with a small forcing pump, which is inexpensive. By allowing the water to percolate from it, at intervals during the day, the heated glazed surface is greatly cooled, whilst at the same time accumulated dust, soots, &c., are removed. and cooling.

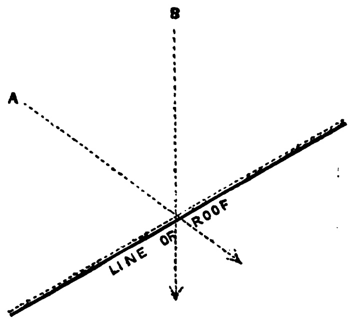
The slope of the glass roof should be so arranged that at the part where the sitter is placed the light may be incident upon the subject with the least disturbance of its components; an angle of forty-five degrees, if the angular form of roof is used, will be the best; but if the extra expense is not an object, much better results will be obtained from the adoption of the half-cylindrical form—as the writer's experience of the qualities possessed by two glass studios, in identical aspect and in juxta-position, but of the two forms in question, leads him to give greatly the preference to the circular, as possessing more evenness and greater rapidity

Best form for its roof, circular;

under equal conditions of light. It may be accounted for in this manner—owing to the continual variation in the position of the sun, it is not possible to adjust the angle of the straight-sided glass roof in such a manner that the light may pass at right angles, and with the least disturbance or loss of a portion of its power; by the obliquity of its impingement on the glass; it will, except at one particular interval, be incident at an oblique angle to the glazed surface, either as at A or B, fig. 29, and thus suffer a derangement or loss of some portion of its actinism, which is probably the reason that in practice the quality of light is found better which has passed through a *circular* form of glazed surface, which always presents the same conditions to the incidence of the luminous principle, whatever may be the angle at which it impinges upon it, as at A, B, C, fig. 30.

disturbs the incident light-less;

Fig. 29.



presents the same conditions to every angle.

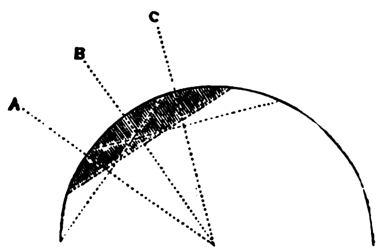
A locality open from N.E. through N. to N.W. is the best during the summer months, taking care that the light is not masked by high buildings towards those quarters, but that, if possible, it is uninterrupted from the zenith to the horizon, which will give the operator the power of using it at such an angle as may best suit the subject he

Its proper aspect for summer work;

GLASS STUDIO may be treating; and modifying, by blinds, the greater or less degree of intensity of light on the features of his sitter, according to circumstances.

for winter. In the winter time, and during decidedly "dull days," pictures can be taken lighted from a southern aspect of good qualities, when no successful result can be obtained in a northern.

Fig. 30.



Results. In one aspect the writer has obtained good dense negatives—consecutively, from the other they were poor, thin, and ineffective.

In summer and fine weather no arrangement of blinds can, by any possibility, give an equally favorable result, should the glass studio, instead of facing the more even moderate light of the

Improper aspect, aspect above described, be erected facing the south; the disadvantages being, that the light is too powerful and most uncertain, and, owing to the passage of clouds before the sun, and from the

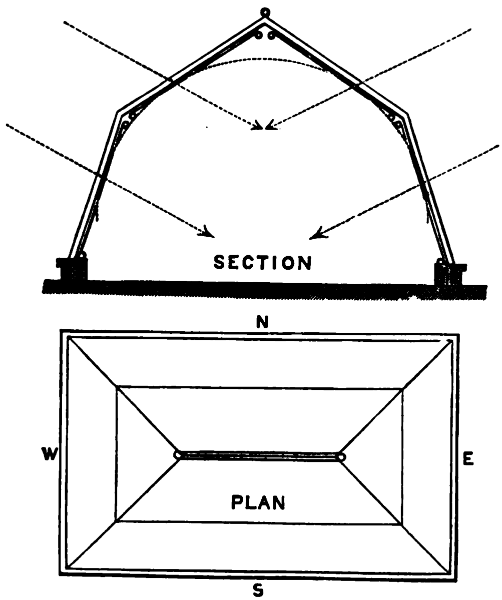
from its variable nature. changes which take place in the light on the sitter, from one second to another, it becomes impossible to calculate with the requisite accuracy the time of exposure; moreover, the potency of the light approaches, in some degree, the effect of the direct sun-ray, and the picture is likely to be harsh and discordant; black shadows and chalky white lights taking the place of the more delicate gradations in both, which should have been seen.

To reconcile *all* conditions of dull and covered weather, or the bright sunshine of summer, and at the same time to meet the desirable angle of incidence on the sitter, a glass studio of this form, fig. 31, when possible, is the very best that can

GLASS STUDIO.

General utility desirable when possible.

Fig. 31.



be built, open *on every side* to light, and capable by opaque and semi-opaque blinds, of being closed towards the south in sunny, towards the north in covered weather, or as much or as little of light used as the nature of the subject requires.

The size of the building will, of course, greatly

Size of the studio.

GLASS STUDIO.

depend upon the class of pictures which the photographer proposes to take in it. Groups of numerous figures, full-length portraits, with accessories, executed with large lenses, will naturally require more space than works of less dimensions, such as single figures and small portraiture—for the first, forty feet by twenty, thirty feet by fifteen, will not be too large; for the second, twenty feet by twelve, or even fifteen feet by ten, will suffice.

Regulated by nature of subjects.

The means of diminishing light, when in excess, by white and black blinds, should be arranged; they should be fixed half from above and half from below; from the eaves and the ridge of the roof, thus giving the power to the operator of not only regulating exactly the quantity but the *angle* of light used to the subject, from about twenty to fifty degrees, as may seem best to him. The floor should be constructed with the greatest care and solidity, many failures arising from the tremor imparted to the camera by movements across a weak floor, and which are increased in their detrimental effect in proportion as the camera is raised in height from it.

Arrangement of blinds.

Solidity of floor.

Colour of walls,

The walls should be distempered or hung with paper, in which greys, blues, violet, *bluey* greens, or white are the only colours—or one or other of them at option—avoiding strictly patterns in which yellows, yellowy greens, reds, or browns appear; which must also be considered in the carpeting or drugget.

and carpets, &c.

Such a room will be found extremely variable in its temperature, in excess of heat in summer and of

cold in winter; ventilation at a *high level*, and arrangements for warming, by hot-water pipes or stoves, must be provided; and from this quality it is obvious that the cameras should be removed after use, in order that they may not be rendered inefficient by the warping and derangement of their parts, and that no chemicals of any description should be kept in any part of it.

GLASS STUDIO.

Its temperature.

It will be necessary that no considerable varnished or French polished surfaces are in it, since the reflection which they would give might occur in a manner to derange the light and shade on a sitter, and the vicinity of any bright or glittering objects would be seriously detrimental in copying oil paintings.

Polished surfaces detrimental.

It is of great importance that the glass studio should be in as immediate contiguity as possible to the operating room, as thereby delays are avoided, which in warm weather may have damaging results, in causing the collodion film to lose sensitiveness.

Its contiguity to the operating room.

THE OPERATING ROOM.

A little contrivance and knowledge of the requirements which have to be provided for, will make the difference between an inefficient black hole, and a room in which the operator can work with celerity and certainty.

Should be conveniently arranged.

Small and inconvenient dens may be made to do duty on occasion; but if it be possible to obtain a certain space, say sixteen feet by twelve, for the

OPERATING ROOM. purpose, it will be well bestowed, both in the increased convenience for the production of the negatives, and for the health of the operator, by the superior ventilation it affords.

Its aspect. The aspect should if possible be N.E., to avoid the direct rays of the sun upon its yellow blinds; the window should be glazed with yellow glass, by the light transmitted through which paper may be excited and bath solution prepared; but in operating for the camera, a curtain of one, two, or three thicknesses of yellow tammy in addition will be found necessary, according to the greater or less sensitiveness of the preparations.

Yellow light alone admitted.

Means of heating. The room should have a fire-place for warmth in winter, and ventilation, or drying of excited papers; and if there is a small boiler for hot water to the stove, it will be found advantageous in a variety of manipulations.

A large Arnott's ventilator at the top of the room in the flue, and an air-shaft, diaphragmed, *not admitting light*, with small flap doors to close when desired, at the level of the floor, near the developing sink, will assist to carry off the fumes of the chemicals.

and ventilation.

Operating sinks. Two sinks lined with *gutta percha*, with waste-pipes of the same material, should be fitted *entirely separated* from each other; one for developing the picture, the other for standing the negatives in to steep in water, which should be laid on with several taps to both sinks. Gas likewise should be fitted along the sinks with *deep yellow* glass chimneys to the burners. Shelves for bottles, and a

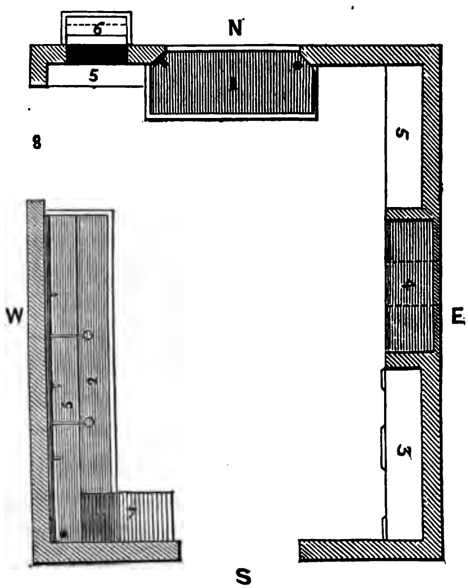
Water and gas.

Shelfing.

well-made *close fitting* cupboard for chemicals, are wanted; at the same time it is especially advised not to make the shelves of the dark room receptacles for all the nameless rubbish apt to accumulate in such a locality, and thereby establish dust-traps to the certain deterioration or destruction of future pictures. **OPERATING ROOM.** **Cupboard for chemicals.**

Let the dark room only contain those things which legitimately belong to it; let the shelves,

Fig. 32.



1. Developing sink. 2. Sink for washing negatives, with gas and water laid on. 3. Cupboard for chemicals. 4. Arnott's ventilator. 5 5 5. Shelfing. 6. Air-shaft. 7. Rack for trays. 8. Door into glass studio.

OPERATING ROOM.

Necessity of extreme cleanliness. &c., be washed frequently and kept free from dust, the sinks in the cleanest condition, and the floor covered with oilcloth, as being the material with the most unbroken surface and most easily purified from dirt.

Precautions against white light. It is imperatively necessary that not the *slightest* gleam of white light be allowed to penetrate into this room whilst operating; plates may be spoiled one after the other by a half open keyhole opposite them when draining, or by a forgotten cranny at the bottom of a door. Curtains to remedy this are not proper, they accumulate dust in their folds, and the movements on drawing them disperses its motes through the air of the room, to settle ultimately on the film; if the doors are leathered, or have wooden fillets screwed round them, either are quite as effectual in excluding light, and more cleanly.

Lead detrimental for sinks, pipes, &c. Note, that if lead linings or pipes are used for the sinks, they will be acted upon by the chemicals, will soon be full of holes, and the vapours of their combined action are most unwholesome.

ON CAMERAS.

Annoyances if badly constructed. In selecting a camera it is necessary to see that it is of the best quality, both in seasoned material and good workmanship; otherwise the patience of the operator will be severely tried, if his picture be not spoiled, by "slides" which will not stir, and "moveable bodies" which are obstinate fixtures; and by light—which in photography must

be regarded as a destructive as well as producing agent—finding its way to the film, through many apertures besides the lens; these tribulations generally happening when some subject more important than usual is under treatment. CAMERAS.

Their various forms,

Cameras vary considerably in their make, according as they may be destined exclusively for portraits and groups of figures in the studio, or being intended for landscape and out-door work, are made to fold together and be as portable as possible. Considerable ingenuity has been shown in the adaptation of all photographic apparatus to the purposes required, and in none more than in the manufacture of cameras, which have been constructed in so many ways, that the beginner may be puzzled to make his selection. I would advise him to eschew all idea of the purchase of a *cheap* or foreign one, as generally they are made of ill-seasoned wood, and are of inferior workmanship, in which a straight line appears to be the exception.

and quality, described.

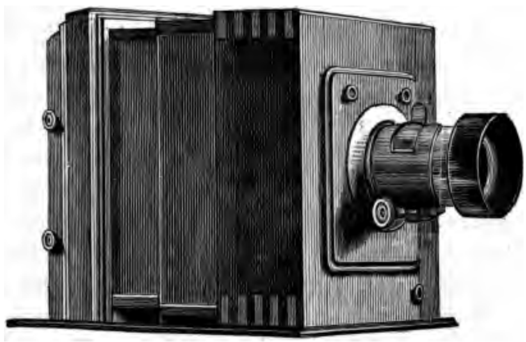
It will be unnecessary to describe many forms in which cameras are made; the smallest sizes are very simple and inexpensive; for portraiture, fig. 33, the square form is the best; the camera can be made to alter for length of focus by means of "sliding bodies" in wood or, in the writer's opinion, better by collapsible "bellows" bodies in leather, the advantage derived thereby being, with the same camera, a largely increased range for focus with various lenses. All portrait cameras should have a "swing back" to allow a slightly inclined position to be given to the collodion film in sub-

Portrait camera.

CAMERAS. jects of difficult focus, or when "*short focused*" lenses are employed for children, &c.

Landscape camera; For landscapes, fig. 34, out-door work, or foreign travel, greater portability than the above is

Fig. 33.



requisite, which is best obtained by the greater portion of the body of the camera being made in leather, collapsible as before mentioned; whereby weight is reduced, considerable saving of space is effected, and a very varied range for length of focus of different lenses obtained which was not easy in the obsolete "folding-sliding" form; in this more recent construction the oblong landscape form can, by changing the position of the body, be rendered vertical for cathedral interiors or other upright forms of subjects.

recent construction; obsolete form.

As it is desirable that several lenses should pass the same camera, it should therefore be made of sufficient length to suit the one of longest focus. The means of changing them with ease and rapidity is to have brass collars, called by the

Means of changing the lenses.

opticians "*adapters*," which screw into the front of the camera, and thus make up the difference between their diameters. CAMERAS.

For portraiture excellent sizes are 12 × 12— Dimensions for portraits.

Fig. 34.

10 × 10 with 18 inches focus; 8 × 8 and 6 × 6 with proportionably less.

For landscape 18 × 14—12 × 10—9 × 7—7 × 5 are good proportions according to the size of pictures intended to be taken. Either should have sets of inner glass-holders or frames enabling the operator to take diminishing sizes when required. Observe that it is of great convenience so to plan the sizes that one plate box will take two different sizes, 9 by 7 upright will take 7 by 5 across, &c., thus enabling the landscape photographer to go afield with one instead of two plate boxes. Sizes for landscapes.

Having procured the camera, it will now be necessary to test it for two qualities; first, its im- Tests of its perfectness,

CAMERAS. permeability to light. Withdraw the ground glass, and covering the head and shoulders very completely with the focusing cloth, the lens having been capped, look into the camera and examine well for any crevice through which light may come; if none is seen it is perfectly sound, and the greatest aim must be to keep it so. Now test it to see that the inside of the focusing glass and the film side of the glass *in situ* in the slide accurately correspond. To do this focus carefully on an object with the full aperture of the lens, with exact precision, and take a small picture; in different qualities. if that object be not in the best focus of the negative, either the chemical and actinic foci of the lens do not correspond, or the construction of the camera is defective, and the ground glass and collodion slide do not agree.

In operating from the life, where delay is most injurious to success, whether it be a portrait, group, or study of animals, it is very desirable that some contrivance should be made by sliding facilities. or hinging, so that the focusing screen shall with the least possible delay make way for the excited film. The camera makers have several modes of accomplishing this end.

Whatever skill may have been shown in the perfect construction of the camera, do not for a moment suppose that it can keep out bright sun- Careful usage necessary shine when full upon it out of doors; under these conditions it must be rigorously kept covered with a thick baize, and the collodion slide should also to maintain efficiency. be wrapped up in passing backwards and forwards to the camera; not only to prevent access

of light to the film, but also to retard its drying during the space of time—more or less considerable according to circumstances—which elapses before it is placed *in situ* in the camera. The same precautions should accompany its return to be developed. This more particularly applies to outdoor photography, but even indoors is better attended to; and the cloth cover kept over it in drawing up the flap. Never let it stand in the sun, no wood can resist that; nor in a draught between open doors and windows; its parts are thin and delicate, and will warp by such usage. Let it be removed, immediately after operating, from the glass room, where the variations of heat and cold are great. It should be covered with a thick woollen baize, and it and the collodion back should be well blotted from bath drainings as soon as study is finished. As before mentioned the contrivances for cameras are very various and numerous, but, provided the *workmanship is good* and the *material seasoned,* the more simple the arrangements the better.

Nature of precautions.

With respect to the cameras necessary to execute the *Stereoscopic picture,* it has been thought better, as they pertain very entirely to the different modes of treating that subject, that the description of the varieties which may be employed, according to the nature of the work undertaken—or the number of pictures simultaneously or successively produced—should accompany the section "Stereoscopic Pictures," as more necessary to its clear elucidation.

Stereoscopic cameras.

CAMERA STANDS.—In order to place the camera

CAMERAS. at a proper height and position opposite the object proposed to be copied, it is fixed on a stand; Their forms if portable. these are usually made of a tripod form, and are very various in their construction, according to the size and weight of the camera they are purposed to carry, and likewise whether intended for landscape and out-door work, or exclusively for use in the studio. The first are so contrived as to fold together and take the least possible space, but are not well adapted to carry cameras of Liability to accidents. large size, and even with the smaller sizes are very apt to upset by the overbalancing of the camera, the sway of the legs at the joints, or the action of wind; they will require precaution on the part of the novice to guard against these accidents, which are very damaging in their effects both on camera and lens.

Portrait stands. Those intended solely for working at home in portraiture, &c., are of a more solid construction, which prevents their being liable to the inconveniences above described: the chief points to study in selecting are the power of placing, with the utmost facility, the camera at such height, distance, Qualities necessary. and inclination to the sitter, as the nature of the subject may require; and that when placed the camera may be so solidly attached and held, that not the slightest tremor is felt by it. These points Preferable form. have been found in practice, by the writer, to be very well provided for in the stand represented at fig. 36. There is a rack-work for raising and lowering, and screws to fix it when at the required elevation; the castors allow it to be easily moved backwards or forwards, and the camera may be

dipped as required by the movements of appropriate screws. CAMERA STANDS.

The security and comfort in working is so great with the more solid stands, particularly with large sizes, that wherever practicable the student Safety of large.

Fig. 35. Fig. 36. Fig. 37.

is advised to give them the preference in all subjects where the transport of them will not be found too inconvenient.

SWING CAMERA BACK.—In operating with the portrait-camera it is most necessary to have the means of advancing or retiring it from the sitter, of raising or lowering it, of placing the *centre* of the lens opposite any portion of the field which may be desired, and of changing the position of the Perfect command of position necessary.

CAMERA STANDS. film from the precise vertical into such deviation of angle, laterally and vertically, as may best enable the action of the lens to coincide with the lines of the subject undertaken.

How obtained. All these movements are provided for by various ingenious contrivances; castors, and rack and pinion movements on the stand, moveable camera fronts, with double action, to hold the lens, and "*swing backs*," to carry the film, allow the operator to alter the distance and position of the field as may seem most desirable. The action of the swing back is intended by its motions to neutralize the distortion which results in using lenses of very short focal lengths, but it will also be found available and desirable with *all* double combinations. Its action is illustrated in fig. 38.

Its use recommended.

On focusing any subject in which the lines are inclined from the direct vertical, as in sitting figures, &c., it will be found impossible to bring the lower projecting portions, as at A, into *perfect* focus with the upper retiring parts at B. Now, if the position of the film is judiciously altered by means of the swing back, the portions defective in focus will be seen to assume equally correct definition with the rest of the subject. This treatment also applies to subjects in which one or the other *side* is nearer to the lens; by slightly altering the lateral distances both sides come in focus. The operator can avail himself of *both* these movements simultaneously.

Its action explained.

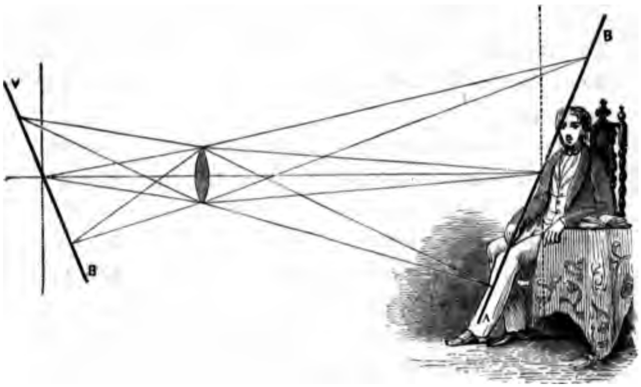
Allows *two simultaneous* movements.

It must be observed that although the "swing back" is useful, in a modified degree, when "short-focus" lenses are employed, much dis-

cretion must be exercised by the operator not to cause an *elongated distortion* of the face and

SWING BACK Discreet use of, necessary

Fig. 38.



person of the sitter by extreme and injudicious use of it.

HEAD RESTS.—Unfortunately in photographic portraiture it is not possible to dispense with the use of this adjunct, which if not used by the operator with the greatest tact will infallibly tend to give a constrained attitude to the portrait—the best, indeed the only way, to use it properly, is to let the sitter go into a natural position of the body and head, and then gently to advance the *crutch* until it just touches him. The writer was long much annoyed in *standing* figures, by the *sway* which there was in the body, which, although the head was supported, occasioned a *doubling of the lines* of the hands, figure, &c., more or less according to circumstances. In large portraits this

A disadvantageous necessity.

Form of, for *standing* figures.

HEAD RESTS. is of considerable importance; as in these both the time requisite is longer, and the movement more defined by the lens; if, on the other hand, the sitter makes an effort to maintain perfect quiescence, that alone gives rigidity to the *pose*. To obviate these inconveniences the form of head rest, fig. 40, has been found very satisfactory.

Strength and rigidity. The stand is made of three-inch deal, also the upright, which is morticed into it. Strong angle pieces of iron are screwed on each side, and a T piece behind; a small cushion is firmly fixed for the back, and a short bronze head rest, *moveable* by screws, is fitted on the top. It is entirely free from vibration, and the "sitter," *merely standing against it*, can turn in any direction and change his position as required. Since this form was first suggested in the former edition various modifications of it, executed with considerable neatness and ingenuity, have appeared. The intending purchaser will, on inquiry at the dealers in photographic apparatus, be able to compare their respective merits.

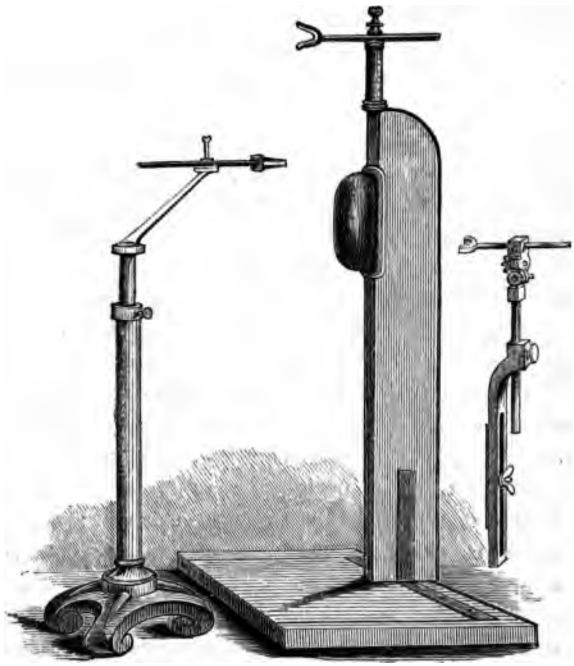
For *sitting* positions. For sitting figures fig. 39 will be found more advantageous. It stands in any required position behind the sitter, and its adjustment is regulated with great facility.

Other forms. The one represented in fig. 41 is made in wood, and is intended to attach to the back of a chair: it has the advantage of cheapness, but is very disappointing compared with fig. 39.

Sitters in general disclaim all necessity for the employment of the head rests, and are con-

fident in their powers to remain "perfectly immoveable;" the operator must not on that account HEAD RESTS.

Fig. 39. Fig. 40. Fig. 41.



discontinue its use, as failures and loss of time are the inevitable results. Still, as was before mentioned, the head rest, injudiciously employed, spoils many pictures, often giving an air of *leaning* or constraint which it must be the business of the artist to avoid. injurious results.

ON THE GLASSES.—Patent plate glass is the best

HEAD RESTS. to use for photographic purposes; it combines the

Desirable qualities. advantages of flatness of surface and a high polish, both most desirable qualities to enable the collodion to flow over it evenly and rapidly. The

Different thickness. numbers 1, 2, 3, 4 (trade mark), being of different thicknesses, these may be ordered, increasing *pro rata* in thickness with the size of the plate, thus sparing unnecessary bulk and weight in the smaller sizes, and giving more strength to the large.

Must be carefully cut. It requires to be properly and skilfully cut, as if carelessly done the operator will, from the same parcel, have some which will slip through the frame, and others which will not go in. They should be set on edge and rigidly gauged to avoid such annoyance, which generally happens when it is of most importance that it should not.

Edges prepared. The first thing to be done is to roughen the edges, which prevents the collodion easily running over the plate, in inexperienced hands, and enables the film to resist better the action of the water which it is necessary to pour upon it; and it likewise prevents it from contracting at the edges.

Mode of doing so. The writer has always done this by the application of emery cloth, which, if neatly manipulated, will at the same time take off the cutting edge of the glass, and leave a band of ground glass, some one eighth of an inch wide—and in small sizes less—on the margin of its top surface, to which the collodion film will firmly adhere, and which will save many disappointments.

It now remains to render the glasses perfectly and chemically clean. The writer has tried many

of the nostrums proposed for this purpose; he has had both baths deteriorated and plates spoiled by the obstinate adherence of some particles of Tripoli or other powders to the edges of the glasses, and therefore early discontinued the use of anything more than *abundance of pure water, running from a tap,* and a clean coarse linen rag to rub the glass with at the same time.* What really is very important is to observe that the red polishing powder, always found on the edges of the outside portions of the plates from which the glasses are cut, is very completely cleared off.

GLASSES.

Care in cleaning.

New glasses.

As soap is used by the glass-merchants to mark the dimensions, &c., of their plates, it is proper to wash the new glasses in a solution of common washing soda and warm water; and if they have been *previously used* they should be placed in water with thin slips of lath between each to ensure the entire surface being acted on; the varnished negative will in about half an hour peel off entirely. Before putting each in mark the back with a diamond, and use that side for the next subject; to glasses that have thus been previously used, much greater attention is necessary in complete washing, friction with leathers, &c., in order to avoid stains on the subsequent negative. After the old varnished film has come off place the glasses in a strong solution of washing soda and hot water for *a few minutes,* rub *well* with rags, then rinse

Mode when new.

When used previously.

Greater precautions necessary.

* The writer—contrary to what is frequently advanced on this subject—can only reiterate what he previously stated; the production of hundreds of plates *free from blemish* from 20 × 14 downwards, causes him to adhere to this opinion.

GLASSES. in plain water. If left too long in the strong alkali the polish of the surface will be injured. Next fill a gutta-percha bath with a *strong* solution of nitric acid and water; take a vulcanite dipper and let each glass *separately* stay in the bath about two minutes, rinse, wash in *weak* soda and water and wash abundantly. This manipulation with nitric acid should not take place indoors as the fumes are deleterious.

Manner of drying. After washing under the tap they should not be put to drain, as even in drying thus they may take cloudy marks difficult to get off; but as each is perfectly washed it should *at once* be dried off with clean linens and carefully put away for use; they should be packed in dozens, standing vertically, in new blotting paper, and not suffered to come in contact with brown paper; nor should they be put in racked deal boxes, as they are sure to be acted upon at the edges in hot weather, by the contact of the terebinous wood, to the manifest deterioration of the subsequent film and nitrate bath. Indeed, even if packed for some time with clean blotting paper between each, held sideways to the light and breathed upon, the form and texture of the paper will appear upon their surface, so that it is not safe to operate upon any glass that has been long put aside, the better plan being to have it *fresh* washed for use. Of course, the impurities of a London or town atmosphere are prone to condense on the cold polished surface of glass, and the photographic glasses should therefore never be allowed to remain exposed to them.

How to preserve.

Precautions.

Atmosphere of towns.

The cloths which are used to wipe these glasses should be of *linen* free from fluff; old napkins are desirable for the purpose. They should never be allowed to come near soap—they should be steeped in warm soda and water, rinsed *abundantly* in many waters, and hung up to dry, removed from all impurities. They should be *well aired*, to avoid mouldy action, which is chemically deteriorating, and kept in tin boxes or well-closed drawers for use.

GLASSES. Glass-cloths.

Mode of cleansing.

In proportion as the summer advances the tribulations of the photographer with his glass plates progress. The hands of his assistant will contaminate the cloths with the impurities of the skin, and from thence result the long smeary marks across the picture. Have several pairs of large common white cotton gloves, rendered chemically clean, and, by a proper use of them, these annoyances will be avoided. The writer thinks that great exertion and of much too vigorous a nature seems generally to be considered necessary to the final polishing off; which is accompanied by a puffing and blowing, ending in depositing on the glass drops of organic origin, which, unheeded in the obscurity of the operating room, are scrubbed in to reappear as blemishes. For final finish, just before laying the film a pad of white cotton velvet, *chemically clean,* held for a few seconds before the fire, gives a lustrous surface; the action should be light and vivacious, and not of the housemaid order. The very last thing is either to blow off any motes of dust, with the air from an India rubber enema bottle, compressed,

Other precautions, in cleaning glasses.

GLASSES. or sweep off with a broad camel-hair brush chemically clean and sedulously kept from impurities.

Convenient mode. WOODEN SCREW CLAMP for cleaning the glasses is a little piece of convenience which all photographers should possess. It holds the glass, whilst being cleaned, suspended in the air and removed from all impurities; whilst it being firmly gripped, by the action of the screw, a considerable amount of pressure and friction can be conveniently and safely applied; it should occasionally be cleaned with soda and water.

Forms of plate boxes. PLATE BOXES to contain the negatives are made in wood and tin with V-shaped racks on each side to take the edges of the glasses. If made in deal the racks should be of harder wood and the whole should be varnished with shellac spirit varnish. When afield the box or boxes taken out should be what is termed *draining* boxes, *i. e.*, with a second opening at the bottom, so that wet negatives may be safely carried home in them. As before noticed *one* box may be made to do duty for *two* sizes of glass.

Silver wire dippers. DIPPERS.—The best dipper for travelling is a piece of *pure* silver wire, bent in this form, Fig. 42, and where required to be joined, which should be at A, not at the lower end, fused not soldered.

Advantages. It has several advantages. Its first and greatest, that it never breaks and disappoints the operator at home; or, what is worse, on a remote journey. The jar of the metal against the bottom of the glass bath is less likely to crack it than the *glass* dipper would be; the plate neither slips off, nor in larger plates annoys by obstinately adhering to the

Clean condition.

dipper; it is cleaned with the greatest facility. It should be washed immediately after operating, wiped with a chemically clean cloth; if used in a slovenly manner it will turn black and be deteriorating to the bath solution. (Note, be sure that there is no *alloy* in the silver wire.)

APPARATUS.

Precautions.

Fig. 42.

For home use, if not the preceding, nothing is so good as the *fluted* glass dipper; the form strengthening the material, whilst avoiding the certain contamination communicated to the bath by contrivances less chemically pure.

SCALES.—Of some size, to weigh hyposulphite of soda, &c., in larger proportions. (These should have removeable concave *glass* disks to place in the metal pans, which preserve the chemicals from contamination by contact with the brass.)

With glass disks.

BOX OF SCALES, of less size, with *glass* pans, to weigh the smaller quantities of chemicals, up to one ounce. (Note, that great exactness and cleanliness are necessary in using these scales, as a small portion of pyrogallic acid, &c., adhering to them would suffice to spoil entirely a nitrate bath solution. When weighing out crystals of nitrate of silver, &c., it is well to cut two small squares of *filtering paper*, of precisely the same size, and place one in each scale.)

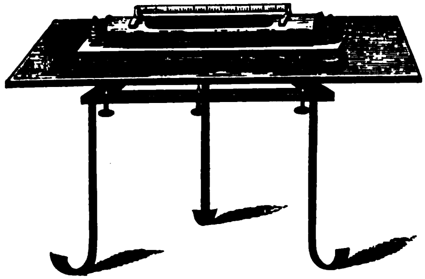
Precise cleanliness necessary.

APPARATUS.

The best form.

Developing stand.—The usual and best form is the tripod, which is more easily adjusted to a level, by means of its screws, than the square; it is well to have two sizes for different dimensions of plates.

Fig. 43.



To adjust it place a glass on the screws, and on it, as shown in the cut, the spirit level; having centred the "bubble" in one direction by turning the screws, alter its position to the opposite angle.

Mode of levelling.

The *level* is not perfectly attained until whichever way it is turned on the glass the bubble remains stationary in the *centre*. (Note, that it is necessary to the even flow of the developing solution that this should be accurately regulated.)

Judicious use of

The developing stand should only be used for large sizes, and even for them not until the development has well advanced; *gentle* rocking backwards and forwards in the hand promotes a more even action, and avoids stains on the negative. But the stand is necessary to deposit or rest the plate when desired.

APPARATUS

DRAINING RACK or stand is a very necessary and useful piece of apparatus which can be procured at any of the vendors of photographic apparatus. As a rule it is not safe to place the finished and washed negative vertically to dry on any surface which touches it largely on one of its sides; as, by capillary attraction all sorts of small particles climb its surface and, adhering to the wet film, resist the camel hair brush, and are varnished in to make their unwelcome and permanent appearance as part of the subject on subsequent printing. The draining stand has V-shaped racks of gutta percha, which, touching the negative only at two small points, and—being itself kept dusted—raises it away from impurities. A long thin strip of blotting paper placed, like a tail, against the drop on the back lowest angle of the draining negative, conducts the accumulated moisture quickly away.

Its advantages.

Prevents blemishes.

PNEUMATIC PLATE HOLDER.—This ingenious little instrument can be procured at any of the vendors of photographic apparatus, it has the advantage of leaving the *edges* of the glass plate entirely free from contact, and consequently the collodion from contamination; motion is communicated from the *centre,* as from a pivot, and change of level is given to the plate in laying the film with greater convenience than in other methods, in the larger sizes especially, in the small it is less necessary.

Advantages of its use.

SPECIFIC GRAVITY BOTTLE should be in the operating room of every photographer; since without it he will be unable to know whether

Its necessity.

7

APPARATUS.

many of the chemicals he employs are of the degree of *strength* and purity it is requisite they should be; as, for example, the alcohol *absolute* and washed ether, which, in summer, are in daily use, for adding to the thickened collodion, and likewise for testing other chemicals.

Its nature; This bottle is of a globular form, with a *perforated* stopper, through which the excess of any liquid passes when the bottle is *quite* filled, thus ensuring exactness in quantity; there is a weight which exactly counterbalances the *bottle* itself. The dimension is adjusted to contain precisely 500 grains of distilled water; if now the bottle be filled with alcohol *absolute*, which at 60° Fahr. is 0·794, or *newly washed* ether, which at the same temperature, barometer at 30°, is 0·725, on weighing, the contents of the bottle will show a result in grains which, multiplied by two, gives the specific gravity.

and mode of using.

Used for nitrate bath. GLASS BATH.—To contain the nitrate of silver solution nothing can be depended on, for chemical purity, but glass; formerly the glass baths were "made up" of several pieces of plate glass cemented together with marine glue, and much disappointment and annoyance was continually experienced by their leaking, and the separation of their parts. Now *solid* glass baths are made on the Continent, which offer every advantage; they can be obtained to take plates up to the size of twenty by fourteen inches. They are mounted in wooden cases to save them from fracture. The writer has them with caps of vulcanized caoutchouc *covered* with sheet pla-

To be strengthened.

tinum, and also of ground glass mounted in wood, both, of course, when closed being secured by clamps, and thus forming as it were a bottle. The advantage being, besides saving of time, that all messing of the bath, in pouring through dubious funnels, &c., is avoided, and if the bath top is ground *perfectly* true, no leakage occurs on moving it. When operating the above caps should be *entirely removed* and carefully kept from any contamination of their inner surfaces. A loose operating cover of wood or gutta percha is necessary, on the bath, to keep out light, dust, splashes of developer, &c., &c.

APPARATUS.

Improvements.

WEDGEWOOD TRAYS should be used *exclusively* for albuminizing and preparing plain paper, and holding the toning and fixing solutions; but those once taken for the two latter purposes should *on no account* be afterwards put to any other uses, since the nature of hyposulphite solutions is so searching that they traverse the entire structure of earthenware, as may be seen by filling a jug with them,—cottony efflorescence and crystals will soon form on the *outside*. Neither are these trays capable of resisting the action of the sixty-grain nitrate solution used in exciting paper, which should therefore only be put in a *glass* tray, as described. They are the cleanest and most satisfactory for steeping the proofs in water after they are toned and fixed; it is better not to have them too deep, and overcrowd the proofs, but to use *more* of the shallower ones, and thus separate them more effectually.

Used for solutions.

Penetrating nature of hyposulphites.

Used for steeping the proofs.

APPARATUS. The number and sizes required depend entirely on the nature of study undertaken.

Advantages and disadvantages. GUTTA PERCHA TRAYS have the great advantages of lightness and immunity from breakage, but are not proper to use for the exciting or toning solutions, since they impart an indelible though slight tinge of brown to the paper. They can be used with albumen, and to steep the proofs in water if desired, but earthenware is preferable.

Some quantity requisite. DEVELOPING GLASSES, &c.—A dozen in *three* different sizes will be found convenient, and save much confusion in operating. A *cup* shape has been found by the writer the most handy in every way. They should be selected with *rounded* form of bottoms, inside, to facilitate *perfect* cleaning, also the "punty marks" ground off and bottoms, outside, polished.

GLASS PESTLE AND MORTAR—is used in reducing crystals to powder, and thus prepared they can be dissolved more readily when the operator is pressed for time.

GRADUATED GLASS MEASURES—1 quart, 1 pint, $\frac{1}{2}$ pint, 2 ounce, 2 drachm, 60 minim. These measures and glasses will require great care in cleaning, that no trace be left of any solutions previously prepared or used in them, as a slight contamination of one by another would have serious results. The cloths used should be chemically clean, as those used for the glass plates.

Precautions to be observed.

GLASS SPOONS—are very useful in manipulating crystals of nitrate of silver, pyrogallic acid, &c., thus avoiding contact with the skin.

GLASS STIRRING RODS—of different lengths, for

solutions (those used for nitrate bath solution to be kept strictly apart). APPARATUS

FUNNELS must be of *glass,* and kept *strictly separate,* for the nitrate bath solution, and for the developing, exciting, and toning solutions. Two or three of gutta percha are useful for other purposes. Of glass, and gutta percha.

THERMOMETERS are very requisite, both in the operating room and glass studio, in order that the photographer may observe the temperature, and take means to equalize it as much as possible, by the use of blinds, evaporation, ventilation, &c., in summer, and stoves and hot-water pipes in winter; and that knowing the precise degree, he may arrange the strength of his developer, and make necessary calculations respecting time of exposure, &c., accordingly. The exact temperature required.

Fig. 44.

RETORT STAND is of great convenience when preparing solutions, to hold the funnels as shown in the cut, thus avoiding accidents in the upsetting of the bottles, &c. When filtering into *measures* it becomes indispensable, to avoid personal attention. Used in filtering;

In fusing any chemicals, and in various experiments connected with in fusing chemicals.

APPARATUS. Photography, the retort stand will be found very useful to the practical photographer.

HORN TONGS are necessary to take hold of the corners of the paper in albuminizing, exciting, toning, and fixing; not only because contact with the fingers in the first two leaves stains on the paper but also that to immerse them in solutions containing particles of metal, most minutely divided in hyposulphite of soda, as the gold and silver in the two last, is *decidedly deleterious to the operator*. Care must be taken to keep a pair for each purpose, and that those intended for nitrate of silver solutions are separated from those used in hypo solutions.

Prevent contact with solutions.

AN ARGENTO-METER for testing the strength of the nitrate of silver solutions—both bath and printing.

Keeps the hands clean.

A VULCANITE DEVELOPING CLIP—made by Murray and Heath—is of the greatest use in preventing the staining of the hands and nails. It is *perfectly efficient* for the purpose named, but is best only used for sizes *under* 10 × 8. It should be washed thoroughly under a tap, and dried after use, before putting it away.

A "GLAZIER'S DIAMOND" for cutting or reducing glass plates or negatives. A "*writing*" diamond for names, dates, &c., on the sides—at back—of negatives.

GLASS BOTTLES.—To select the proper descriptions, according to the uses for which they are intended, is of much more importance than might appear. There have been several collodion bottles contrived, some with a view to straining or

Glass bottles for collodion;

filtering it from the deposit by percolation through sponge, &c., &c., but no method for keeping collodion in perfect order for use is equal to the simple one of having one or two *very tall* stock bottles. The pressure of the column of collodion carries to the last half inch of the bottom all flue, dust, and fragments of dried film, which are very destructive agents in producing blemishes on the plate. It is easy to decant *gently*, from the upper portion, into a smaller size for use, keeping the stock bottle replenished as may be requisite; the same treatment is equally necessary to be adopted with the varnish.

APPARATUS.

their form,

In order to appreciate the degree of failure avoided by these precautions it is only necessary to lay a film, or varnish a plate with the lowest strata of either bottle.

Utility exemplified.

For works of large size, 20-ounce *tall* stock bottles, fourteen inches high, are not too large,—12-ounce for smaller sizes, &c. In laying the film, 4-, 6-, 8-, or 12-ounce, *two thirds full*, are good sizes; smaller bottles are convenient to preserve odds and ends of collodion, which all have their uses in the treatment of various subjects.

Various sizes

Washed ether, for thinning the collodion, and alcohol *absolute* require corked and *capped* bottles, and it is better that they should *not be large*, since when a large bottle is only half or one third full, the remaining portion is filled with atmospheric air, which deteriorates both the above, which are required in the utmost possible state of purity. Instead of one, it is better to have four or six

for ether and alcohol;

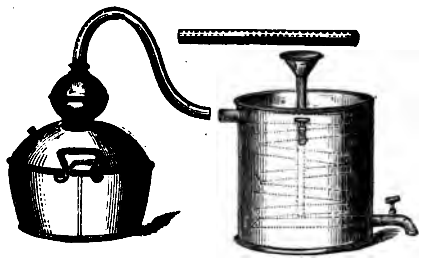
their requisites.

APPARATUS. smaller, carefully corked, tied up, and capped, to open as required. It will spare the chemical cupboard from unpleasant fumes if the use of capped bottles (*glass* stoppers) be extended to nitric and glacial acetic acids. A few wide-mouthed stoppered bottles will be required for crystals of nitrate of silver, pyrogallic acid, &c., and ordinary stoppered bottles, of various sizes, for different solutions.

Other bottles.

STILL.—Much distilled water is required in the process, especially when large sizes are undertaken. In cities, carboys of it can be readily purchased,

Fig. 45.



and the time of the photographer not intruded upon by its preparation. When operating away from home a small still gives the means of being certain of a supply. When the body is filled with water it is corked up, and put on a fire; the "worm-tub" requires to be kept full of *cold* water, which, as it becomes warm, is drawn off, and fresh added through the funnel. Rain water can seldom be obtained sufficiently pure, being contaminated by contact with oxidised lead gutters, &c.

To prepare distilled water.

Other expedients.

Clean ice melted gives very pure water, and may serve on an emergency. APPARATUS.

SPIRIT LAMP when operating away from home is necessary. If the atmosphere is damp it may be carefully applied *for a few seconds* to the back of the glass plate, just before laying the film; the moisture will be seen to leave the surface. When the negative is finished it affords the means of heating the plate previously to *varnishing* it, thus putting it in safety before returning home; but considerable caution is required in thus using it, or a valuable negative may be broken. Used in laying the film, and varnishing.

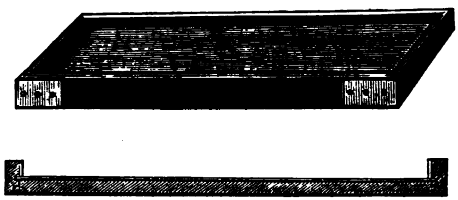
PRINTING FRAMES are used to place the negative, with the excited paper superposed, in the light. They should be purchased with *jointed* backs, to allow the progress of the action to be inspected. Note well that the thick front glass does not fit so tightly that it cannot be *easily* pushed out. This is a fertile source of broken negatives. These frames are exposed to great and sudden variations of temperature; and in large sizes if the "thick plate" is jammed in tight, as is often the case, it is sure to be destroyed, and most probably the negative will share its fate. Their use, and liability to accidents.

EXCITING TRAY.—No substance or surface equals glass for containing the 60- to 100-grain solution of nitrate of silver used in exciting the paper for photographic printing. Gutta percha communicates a very distinct brown tinge to the paper, indelible by the subsequent processes. The glaze of Wedgewood ware cannot withstand the action of the solution, which traverses its structure, and the surfaces of both are deficient in evenness. If Of *glass* necessary. Others, deteriorating.

APPARATUS. large sizes are required the only mode of obtaining glass trays for this purpose is to *construct* them of plate glass, as it is not possible to procure them of large sizes in one piece. The method given in the cut has the advantage of giving support, by

Large dimensions.

Fig. 46.



the wooden casing, to the glass plates, thus keeping them in their form and preventing risk of external injury. It is necessary that the casing should be made of *well-seasoned* mahogany, otherwise the very means taken to protect the glass would, by the shrinking of the wood, destroy it. If a white millboard or paper is put on the wood by the maker, previous to the bottom glass being placed, it will enable the operator to detect with more facility any impurities which may be in the solution or on the surface of the glass; for small sizes moulded solid glass trays in one piece are procurable.

Wooden casing.

Quality recommended.

FOCUSING CLOTH.—The best substance for this purpose is a square piece of cotton velvet; it will be found to adapt itself better to the movements of the operator than the cloth, sometimes recommended for this purpose. A thin India-rubber cloth should, however, always be taken as well for *outdoor* work, as it saves the camera, &c., from

Serve other purposes.

sudden showers of rain. Straps or India-rubber bands are useful, and some squares of yellow and black calico, single and double, are very handy. APPARATUS.

FOCUSING EYE-PIECE.—Is of great utility, it enables the operator to examine the definition of the picture on the ground glass screen, and to determine the exact focus with greater accuracy than is possible with the unassisted eye. Importance of it in focusing.

LINEN CLOTHS, for cleaning the glasses, are better of *old* table-cloths, napkins, &c., than of *new* material. A pair of India-rubber gloves to handle the glasses when dipping them in the strong nitric acid, page 92, and for use in similar manipulations. Some pairs of *large* white cotton gloves for the assistant who polishes the glasses. Some *old* silk handkerchiefs and some wash-leathers; the whole of the above must be rendered and preserved *chemically* clean, as described article "Glasses." Two or three *very soft* wash-leathers, the dust well beaten out of them, *not washed,* to clean the lenses. Several linen bags washed chemically clean, water and soda, no soap, to keep the foregoing in. The qualities required.

TEST AND FILTERING PAPERS.—Litmus and turmeric papers required for testing the nitrate bath, toning bath, &c.: filtering paper *of the best quality* for the nitrate bath and solutions, and abundance of new blotting paper for the manipulations. Use of test papers.

Note, that the foregoing is a list of *complete* apparatus proper for executing works of importance; it is easy to suppress some items, and diminish size in others, should the nature of the study undertaken not necessitate them.

PART III.

MANIPULATIONS.

MANIPULATIONS.

PREPARING THE CAMERA.—Before placing the film in the camera, it is necessary that the latter should be in every way prepared to receive it, and all precautions taken which may ensure a successful issue.

Precautions necessary;

The lens must be *perfectly polished* with its appropriate leathers—the *inside* of the camera carefully dusted—the exact distance from the subject fixed, and the *size* the object or objects appear, and the *position* they occupy in the field found satisfactory—the height and inclination of the camera decided upon—and the necessity, or otherwise, of using the swing back and moveable fronts studied—two or three diameters of diaphragm must be tried, and their effects on light and focus observed. These preliminaries having been attended to, we next proceed—

their nature.

TO LAY THE FILM.—The glass plate, having been scrupulously cleaned according to the directions given at page 91, is put on the pneumatic holder, and the trigger being drawn down into the catch, the glass is fixed in its place: its surface must have been well polished and treated as before described at the last moment that the operator is ready to lay the film. Observe that all doors and windows are shut; the ether is suffi-

Coating the plate.

ciently rapid in evaporation, and draughts disturb the air, raise and bring in *dust*.

Currents of air injurious.

If there is much humidity in the atmosphere, it is well to hold the surface to be operated upon, for a *few seconds* only, before the fire; the moisture which had condensed on the glass will be seen to leave it.

The stopper and neck of the collodion bottle having been carefully wiped from the horny crusts of former pourings, take the holder firmly in the left hand, raise the plate to the height of the chin, that the eye may readily appreciate the flow of the collodion, hold it *perfectly* level, keep it at arm's length, and especially refrain from talking and breathing over it, as the moisture of the breath becoming condensed on the surface of the glass would seriously deteriorate the film.

Mode of holding the plate,

Now, lowering the mouth of the bottle down within an inch or so of the glass to avoid bubbles, splutterings, &c.,—to do which the bottle must not be more than two thirds full—pour *firmly* and *steadily* in an even stream—without pause or jerks—until there is sufficient collodion to cover the size of glass that is being operated upon. Practice will soon determine the quantity necessary, which is about three fifths of the entire surface; the student should hasten to acquire this knowledge, as if too little is poured on the glass, loops and streams will be formed, encircling bare glass, and the latter then becomes most difficult to cover evenly.—If too much is poured out, collodion will probably be wasted by running over, in getting the superfluous quantity back into the bottle.

and pouring the collodion.

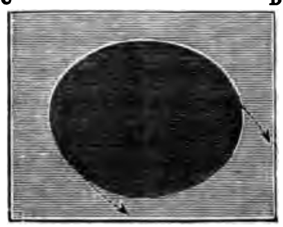
Quantity necessary.

MANIPULATIONS.

A few trials will give *firmness*, neatness, and quickness to the manipulator.—The best way in covering a plate is that in which the collodion has only to travel *once* over the same surface, and not, as it were, form a second strata, by returning over part of the half set first, to the pouring off corner.

Mode of covering

Fig. 47.



To accomplish this is most simple; in pouring it is easy to give such a slight motion as shall cause the pool of collodion to assume an oval instead of a round form, fig. 47, having sufficient, stop pouring—a depression of the corner A will bring the collodion to the

illustrated.

Fig. 48.

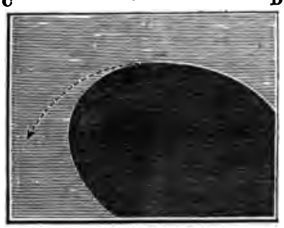
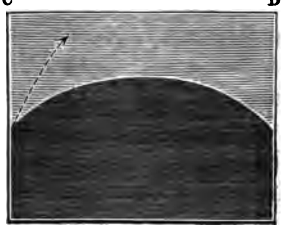


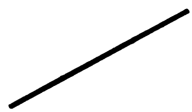
Fig. 49.



edge, in the form shown (fig. 48); on lowering the corner B the collodion flows to it, and there is, as shown in fig. 49, now only one motion, of a slightly rotary kind, which sends it at once both to complete the corner C, and to D, which, being inserted in the mouth of the bottle, the

MANIPULATIONS.

surplus is poured off gently, not *raising the glass above an angle of twenty-five degrees,* as if held up vertically, or at a greater angle, reaminess and striæ will form which cannot be got rid of; rock it *gently*



from C to A, to antagonise the current from B to D, and thereby render it even; if this is done violently in jerks the film will be cracked. This applies more especially to cadmium-iodized collodions, the films of which are thick, viscous, and spongy in structure. As soon as it has done running, in hot weather—or after it has stood a few seconds *horizontally* in cold; take it from the holder, place it on the dipper, still keeping it nearly *horizontal* in position.

Rocking the plate.

Afterwards placed horizontally.

EXCITING THE FILM.—Now, observing that *all white light is strictly excluded,* advance to the mouth of the bath, take off the cover, and with one *steady even movement* lower it to the bottom; should any pause take place there will subsequently appear straight lines of stain, from side to side, across the negative; if the film is dipped too soon, in cold damp weather, crapey fissures in the film will probably appear; if kept too long, before placed in the bath, blank patches of insensitiveness will result; besides the qualities of temperature and atmosphere, the nature of the sample of collodion must be taken into consideration: a thick viscid cadmium-iodized collodion will require twice as long before dipping as a thin subtile one, and if subjected to precisely the same treatment both would

Dipping into the bath.

Different collodions.

MANIPULATIONS. be spoiled. The time requisite to leave the film in the bath varies with the temperature, requiring much longer in cold than in hot weather, and the plate may be left longer in a bath which has been some time in use than in an entirely new one—two to three minutes is a mean time. After it has been a minute or so in the bath, *but not before*, it should be gently raised and lowered, some five or six times, to even the action of the iodide, and then left to complete the time proposed. Now raise it gently, if all oily streaks have disappeared, and the surface appears even, it is ready; hold it a moment at the mouth of the bath to drain, then put it upright on a strip of *clean* double-blotting-paper, leaning the back against a bottle; when it has stood from five to forty seconds—again by temperature and area of surface—to drain, place it in the back or slide, at the four angles of which small pieces of *clean* blotting-paper should have been placed to receive any moisture, and covering the back of the glass with blotting-paper, which should be *in contact* with that at the corners, close the slide, and get it to the camera and in action as rapidly as possible, since delay has the effect of diminishing its sensitiveness by drying the film.

Time required.

Varies with temperature.

Plate drained.

Ready for the camera.

When very lengthened exposures are necessary, as in ill-lighted interiors, or the prepared plate has to be carried some distance, or, that the temperature is high, as in Italy, India, &c., and the film thereby exposed to become dry and insensitive, a piece of *thick* cloth, known as "Melton," or thin felt, covering all the glass to within half

Palliative for delay

an inch of its margins, should be kept for the following use: Just before laying the film, dip it in water; when completely saturated *roll* it up to remove superfluous moisture. When the prepared plate is *in situ* in the holder, place the damp cloth flat against the back of it; the coldness caused by evaporation will retard the drying of the film. When the operations are important—ether, sprinkled over the damp surface of the cloth, has a marvellous effect in lowering the temperature of the glass plate. The writer has exposed a wet film for above an hour under the latter condition.

MANIPULATIONS.

in long exposures.

To EXPOSE THE FILM.—In taking the slide or back from the operating room, or returning from the camera, be careful not to *reverse* or *alter its position* from the vertical, in which it stood during exposure; some bath drainings will be sure to accumulate at the bottom, which, contaminated by contact with the slide, would, if it were not held in the same direction, run back over the film and stain it. If operating from the life, focus *at the last moment* before putting the slide into the camera.

Position of the slide.

Now remove the ground glass, replace it with the collodion back, cover the top of the latter, and keep it scrupulously covered with the focusing cloth, otherwise light *will* get to the film, and uncover the lens without shaking the camera. The time of exposure expired, cover the lens, observe that the sliding shutter is lowered *very gently*, if done otherwise the bath drainings at the bottom will be splashed up the film, and the negative spoiled.

Precautions to be observed.

MANIPULATIONS.

The writer never uses a "cap" to lenses, when operating from the life; he has a box lined with black cotton velvet behind the lens, which is opened by strings *from behind* when he observes the moment to be propitious as to expression in the human sitter, absence of movement in the animal; having thereby more full and undivided attention to devote to the above most important points, instead of having to crane round one way to watch the sitter, another to remove a cap.

Facilities for operating.

TIME OF EXPOSURE.—In the whole range of photographic manipulations the sum of which goes to make up the perfect picture, there is not one of more importance than the correct time of exposure in the camera.

Its great importance.

No fixed data can be given for duration of exposure, since occasionally the subtilty of the changes between very short intervals of time may render one negative intense, and the one immediately following it weak and defective, with the same treatment. Still, by practice, a sort of instinct grows on the photographer, which often leads him to alter on the moment a predetermined thirty seconds into twenty, or *vice versâ, after the film is uncovered,* according as the quality of the light may have impressed him during the operation.

Fixed rules impossible.

The only general rules to assist our estimate of the actinic power are the following, which experience has shown to be the conditions most favorable to the production of the photographic image; namely, the time of day, as near the meridian as may be, when, as has been shown,

The most favorable conditions.

light is vertical to the position, and therefore undispersed and actinic; the purity and freedom from vapours of the atmosphere immediately on the earth's surface; which, to estimate it properly, requires the command of an extended horizon. The time of year—spring and early summer, with a *moderate* temperature—sixty to seventy degrees Fahrenheit—not that it is the writer's opinion that the action of a *low* temperature is entirely deteriorating to the exposure *in the camera;* as during clear frosty weather, unaccompanied by vapours, he has made satisfactory negatives—failure seems more to be caused by the effect of cold upon the chemical agents used in the process, which impedes or arrests their sensitiveness. When this has been carefully guarded against in *clear* weather, in December and January, good actinic quality has been experienced. The temperature of the glass house and dark room at such times must be raised by fires and hot-water pipes, to sixty degrees Fahrenheit, and in that temperature the bath, the developer, the collodion, and the glasses which are to receive the film, must have been kept a sufficient period to acquire the same heat; likewise the camera and lenses; for should they have been brought in from a lower temperature, the vapour from the collodion film would, during the time it was uncovered, be condensed on the lens, and interfere with its action.

MANIPULATIONS.

Temperature.

Effect of cold.

The chemicals, &c., being protected.

Now, although cold weather does not, with these precautions, prevent good and vigorous negatives from being executed; extreme heat has

Effect of heat

MANIPULATIONS.

a very damaging effect, against which no efforts of the photographer will avail; its influence is not only felt in the exposure, but by the chemicals, of which the nitrate bath and collodion are the two most deteriorated in their qualities; this will be found treated of under the head Nitrate Bath, and Collodion. The writer has observed that the action distinctly improves after rain has fallen, whether during the bright intervals between smart showers, or the morning after a more continuous fall; occasionally, even during heavy rain, the action has not been impeded. But the process is retarded, and the action is often entirely deficient in hot sultry weather, in which the atmosphere is surcharged with electricity; a thunder-storm will at once restore excellent photogenic qualities. Elevation of ground is most decidedly favorable.

on the chemicals.

Other influences.

Photographers in general more often commit the fault of under than over exposing their negatives; now it would be desirable to reverse the error, and, if we cannot hit the precise moment of time, that they should, of the two, be over-exposed, since in the former case the result is absolutely valueless; in the latter, we have two favorable chances; one, that if skilfully manipulated, it is in our power suddenly to arrest the progress of the development at a point which shall retain most of the qualities necessary to its printing successfully, the other, that some subjects do not lose by a *slight* over-exposure; it often gives atmosphere and sunny effects in landscapes, and with some arrangements—namely, vignetted

Negatives under-exposed.

Over-exposure.

heads on white backgrounds—delicacy to female portraiture. Indeed, it is more than doubtful whether the greater portion of the most successful results which we see are not more consequent upon this balance of exposure and development, than to the exact timing, to a second or two of exposure. Not that it is possible to produce a fine picture if the exposure has gone beyond a certain limit; the nearer we hit the correct time, the better the result, but of the two errors over-exposure is the less fatal.

MANIPULATIONS.

Its results.

Correct.

DEVELOPMENT OF THE IMAGE.—The whole treatment of this manipulation must be governed by the judicious appreciation, by the operator, of the nature of the subject, its requirements, the temperature, the character of the exposure, &c.; and the nature of the developing solutions used should be made dependant upon these varied conditions.

The development of the latent image comes second only to exposure, if, indeed, it do not, as a governing power, rank before it in producing the resulting picture. By it the operator has every discrimination at his command, unless the light was very bad indeed, or the exposure absurdly miscalculated. If he perceive the subject fogging, he can dash water over it, stop the development, examine it, fix it, wash well, and resume his treatment of it with the clear darks of his subject kept brilliant, by being nearly bare glass, at which, by this method, they will remain.

Its importance to the result.

Size of subject must always be considered in

Different dimensions

MANIPULATIONS. the nature of treatment with the developer, as with the lens; with one, as with the other, more bold or more delicate treatment should be aimed at in proportion as the dimension and nature of the picture demand either the *extreme* of "carte" finish and delicacy for very small sizes, as "carte" pictures or specialities, as astro- or micro-graphy, where it is hardly possible to elaborate too much; then iron development is desirable. When large sizes, 18 × 14 of landscape or figures, &c., are undertaken, this comparatively weak and—for such pictures—over elaborated treatment should give place to the more vigorous deposit and action of the pyrogallic developer. Again the exigences of temperature or subject must be carefully considered; cold weather demands the use of iron, the contrary a cadmium collodion with a pyro developer increasing, *pro rata*, with temperature, glacial acetic, or, when heat is in great excess, citric acid as a bridle to its action and prevention of fogging. In ill-lighted interiors, with dark corners radiating little or no action to the lens, iron.

demanding variation in treatment.

The writer finds that in exteriors of some size, 18 × 14 to 12 × 10, if the lens is of the nature required for treatment of the subject, good in quality and the aperture judicious, a delicacy of definition, equal to any iron developed picture, is readily got by pyro, whilst the more vigorous deposit obtained at one operation, and with facility, has a cleaner, brighter, and better printing quality than that got by forcing up by repeated "intensifyings," necessary on large pictures, to obtain equal

Pyrogallic

density. Thus then it would appear that for *elaboration* in treatment of subjects which, from their small size and nature, require it, iron; for larger works, pyro; for low temperature, iron; for the contrary, pyro.

MANIPULATIONS.

and iron.

TO DEVELOPE THE IMAGE.—The slide having been brought back to the dark room from the camera, we now proceed to develope the picture. Take the glass carefully from the slide by the edges, avoiding touching the film, place it on the developing stand; now take one of the developing glasses,* in which, just before going out to the camera, the solution should have been prepared—a larger one, half full, *depresses* and *spreads* better than a small one full—quickly and skilfully pour the developer, as much as possible at one motion, all over the film, avoiding especially pouring it in one place—now put down the empty developing glass, take the plate by the two nearest corners, and rock the solution rapidly but *gently* backwards and forwards,—if necessary, from portions of the surface remaining uncovered, and not flowing readily, blowing it at the same time. At first, particularly with the diluted solution, it will have a great tendency to draw together in uneven greasy patches, but it must not be allowed to rest, otherwise there will infallibly result stains and blemishes,—after a short interval it will lie smoothly on the film.

Mode of application.

Its action described.

If properly exposed, in medium temperature,

* When afield or at home, with very *small sizes*, it saves trouble to pour the developer direct from the bottle on the plate.

MANIPULATIONS.

Appearance of the image.

the picture should begin to appear in ten to twenty seconds; at this point the experienced operator knows, at a glance, the quality of the negative. Should the image dash out immediately the developer is applied, it has probably been over-exposed—it may be irrecoverably so; in which case a general decomposition immediately ensues. If it has been less, be quick to stop the action with water, which must always be at hand for the purpose. Over-exposed negatives, when held up to the light, show a want of vigour in the deposit on the high lights, and a tendency, more or less, to general indistinctness from fogging. If it is desirable to increase the intensity on the high lights, and to clear the darks, proceed as follows: Apply the saturated hypo fixing solution, or a solution of cyanide,—the writer always uses the former, as acting less on the light half tones of the subject,—when the yellow iodide is gone, wash *well* with plain water, and after rinse with *distilled* water; now placing the negative again on the stand, apply fresh developer, of full strength, with some drops of bath solution decomposed in it, if pyrogallic; the intensifying solution with drops of nitrate solution, if iron; the result will, of course, not be so good as if correctly timed, but generally this expedient will improve a weak over-exposed plate; wash, apply the hypo sol., and steep in water. If the exposure has been faulty, by being too short, the image will appear very slowly, the more so as the light was inefficient or the exposure defective; the white lights first alone, after the high lights

Treatment if *over*-exposed.

Fogging.

When *under*-exposed,

on the face and hands appear; the parts in shadow and dark draperies being entirely neglected, are the signs of such a plate, which is totally worthless, except to serve as a guide for rearranging any parts of the composition which may appear defective, and to regulate the exposure of the next film.

MANIPULATIONS.

Valueless.

If the exposure has been successful the white and light draperies, the heads, hands, &c., will be well supported by other forms, and even in the dark local colours, as of dress, hair, &c., drawing will appear; the development should be stopped when all but the *very deepest* shadows, the pupils of the eyes, &c., are filmed over, the latter should remain *near* bare glass; if taken precisely at this point the picture will have spirit, rotundity, and variety of tones, from the most delicate tints of shadow on white to *small portions* of vigorous and spirited black, which will not only give the necessary scale, but will likewise produce form and give atmosphere to the subject.

When successful.

It is objectionable to use too small a quantity developer on a plate—the chances of stains are infinitely increased. It is also not desirable to use so large a quantity that it runs off the plate, as then it carries with it the silver which was in the film, and which was necessary to form the image.

Too small or too large a quantity objectionable.

APPEARANCES OF THE IMAGE WHEN DEVELOPED.—The developed picture, viewed by transmitted light, differs in its appearance, even when possessing equally favorable printing qualities. There are variations of colour in the image, and of real

Varieties of colour,

MANIPULATIONS. or apparent intensity of deposit, which are caused by the changes and relations towards each other of the bath and collodion, as the acidity or neutrality of either the one or the other predominates. Likewise, independently of duration of exposure, varieties of appearance are caused by change in the quality of the light; often in the same locality, on the same day, with the identical chemicals, negatives differing in translucence or opacity and *colour*, are produced; but which may, notwithstanding their varied character, all have nearly equal properties.

and opacity.

The best qualities in a negative described.

The *best* printing qualities for a negative to possess are the following: the high lights in the picture, that is to say, the most intense portion of the deposit, should allow the flame of a candle to be *just seen* through when held behind them; if of too great an opacity to admit its being perceived *at all*, the resulting positives will probably be chalky and bare in the lights, and deficient in half tones. *Very small* portions, representing actual *white*, should be of absolute opacity. There should be a *general* deposit of silver, with *considerable variations of intensity*, over the whole surface, with the exception of the most vigorous darks, and in them it should approach *very nearly* to the bare glass, but *only in small portions;* if in large masses it would denote under-exposure.

Colour by transmitted light;

Held up to the light, their colour should be of a warm inky brown; when the plate is held horizontally over a dark ground, and viewed by diffused light, the appearance which especially distinguishes the deposit on the film in all nega-

tives of the highest capabilities is a warm *drub* *colour,* technically termed "bloom,"—in negatives developed by pyrogallic solution, in those by iron it is rather more silvery grey and metallic. Such negatives are sure to print well; all the objects represented by them will be *rotund* in appearance, because their forms are thoroughly delineated by delicate half tints, and the extremes of light and dark, with all the *intermediate tones,* will be well expressed. Their effect will be bright and spirited, equally removed from the vapid monotony of *over-exposed* negatives, which, deficient alike in both whites and blacks, lose the power of the scale and range of chiar-oscuro which the two extremes should give them, and from the crude and misshapen forms of the *under-exposed,* which fail, because wanting the softening beauty and *drawing* given by middle tints.

MANIPULATIONS.

by diffused.

Possesses every gradation of tone.

Compared with imperfect.

"Assisted" development.

When the negative has been assisted, in an inefficient exposure, by the addition of drops of nitrate bath to the developer, the peculiar "bloom" of high actinic quality will not appear when examined by diffused light; in its place, darker tones and more opaque deposit of a *blue* or *black* character are seen. They are less satisfactory, being deficient in the truth and delicacy of gradation possessed by the former, and are apt to be very deceptive when printed; dark and vigorous looking negatives occasionally allowing the light to permeate through their texture, whereas the most translucent of these impressed under favorable actinic conditions have a great

Defective, and why.

MANIPULATIONS. power of resisting it, although their weak looking, light brown deposit, would appear ill adapted to do so.

FIXING THE IMAGE.—Having been thoroughly washed from the solution, the developed plate must now be *fixed*. The most convenient mode of doing so, for small and moderate sizes, is tc have a gutta percha bath, with vulcanite dipper, containing the hypo fixing solution; the plate is immersed in it precisely as it was in the nitrate bath. After the lapse of a short period it is raised, and if any of the yellow iodide remains undissolved it is returned to the bath. Some operators use a weak solution of cyanide for this purpose; the writer, having experience of the action of both, gives preference to the former. It is innocuous to the light half tones, which the cyanide decidedly is not; it is apt to prey upon and weaken them, and in confined operating rooms or tent work—especially in hot weather—the fumes of the latter are certainly deleterious to health. If it appears *entirely* cleared, it is taken off the dipper and laid on the film upwards to steep in water. Common jelly-pots make excellent rests to stand the plates upon in a sink. The quantity of water depends on the size of the plate. A quart for the *smallest* size, in four intervals of a quarter of an hour each, will suffice; for the larger, three or four quarts in the same period. If they are inefficiently washed the hypo, or cyanide, will not be dissolved out, and remaining on the film, will make their reappearance in crystals, to the *certain destruction* of the picture.

Convenient mode of fixing.

Iodide must be entirely removed.

The film well steeped in water.

If the sizes are large, or it is not wished to have a bath expressly for the fixing solution, the best mode of applying it is as follows: take a large Wedgwood or gutta percha tray, stand it on some jelly-pots bottom upwards, place the negative on them, and pour the hypo on it from a jug; the solution is not wasted, being returnable from the tray. In adopting this mode, it is proper that the jug used should have a perforated strainer in its spout, which will intercept any crystals of hypo, fragments of film, or other impurities, which would drop on and injure the negative.

MANIPULATIONS. — **Another mode of fixing.**

VARNISHING THE PICTURE.—The negative must have been sufficiently washed with clear water, so as to have removed *every trace* of the fixing solution from the film; at the same time it is not advisable to allow water to remain *too* long, as it then seems to weaken the film, and cause reticulation. In the summer weather beware of the flies, who appear to have a great propensity to settle upon and mark the film, and of the dust, which is likewise injurious. Let the film be perfectly dry (*vide* "Draining stand," page 97); see that the varnish bottle is clean in the mouth; a twelve-ounce tall collodion bottle makes the best varnish bottle, as the weight of the column of varnish tends to sink any impurities to the bottom, and the upper and clearer portion only will be used. Now hold the negative with the back towards a clear fire, or charcoal brazier when abroad, or if from home over a spirit-lamp, not too near, however, and move it gently, so that it may be evenly heated. This operation,

Hypo solution removed. — **Precautions.** — **Negative heated.**

MANIPULATIONS. particularly in cold weather, must be carefully performed, or the glass may fly. Having heated it so that the hand can just be borne comfortably on the back of it, take hold of the corner with the fingers and thumb of the left hand, and pour the varnish on the centre of the plate, send it from corner to corner, precisely as the collodion film is laid, and pour off into the bottle; its subsequent power of resistance to continued printing will be greater if it is held for a minute or two, flooded to the edges, or placed on a carefully *levelled* developing stand, for the varnish to soak into and traverse the film, and not be merely superficially applied. It should not be held *vertically* to drain, which would cause ridges and inequalities on its surface, but must be treated precisely as directed for laying the collodion film: when *nearly* set, it is well to stand it on a slip of clean blotting-paper, which will absorb any varnish, which would form a ridge or "fringe" at the bottom of the plate, and be detrimental when printing.

Mode of applying the varnish.

Effects of over-heating, and insufficient.

If the glass is *over-heated*, the results are that it will possibly fly when the cold stream of varnish is poured on it, or it will seeth in bubbles on the surface; and such a negative, when dry, is sure to be destroyed by the varnish cracking and rising up in scales, bringing the collodion film away from the glass with it. If the plate has been *insufficiently heated*, the varnish will "chill" in drying, and its *opacity* will seriously interfere with the successful printing of the subject. The best varnish to use for this purpose is a spirit-

varnish, manufactured in Paris; it is the 'Vernis Soehnée,' and is retailed in London by most of the dealers in photographic apparatus.

MANIPULATIONS. Vernis Soehnée.

The amber and chloroform varnish cannot be recommended, its powers of adhesion to the plate are too weak; but the writer has known it to stick to the fingers, with part of the subject from the margin of the plate attached, long after carefully finished; for out of door work it may have advantages, when a picture is required to be immediately varnished, as the glass does not require to be heated for its application.

Amber varnish.

If a negative has been printed in the direct sun-light, and has consequently had its varnished surface injured; by placing it on the developing stand, carefully levelled, and allowing chloroform to remain upon it a few minutes, the injured surface will be dissolved, and it can be revarnished when dry; this applies equally to both the above varnishes. Observe that a few hours should be allowed to elapse before printing from the newly varnished negative, or it may probably suffer by adhesion to the paper.

Treatment of damaged surface.

DEFECTS, THEIR CAUSES AND REMEDIES.—Having described the *favorable* appearances in the deposit of silver on the plate, we will now proceed to examine the *imperfections* and show their nature and origin, and this portion of his experience is of as much or more value to the operator as any; for in a process consisting of a great variety of manipulations, on the *complete* success of EACH of which the perfection of the resulting picture is dependent, it becomes of great importance to

Defects; importance of analyzing,

MANIPULATIONS. — and tracing to their source.

possess the power of distinctly refering any failures to their *exact* origin, and thus being enabled to apply the necessary cure. Otherwise, the student would have the mortification of seeing plate after plate appear on development with the same blemishes, to which, having been unable to trace their source, he would be incapable of applying a remedy.

It is well, therefore, to acquire the habit of *never passing an imperfection,* and not resting satisfied until in all the various processes the *one* causing it has been discovered.

Opaque film.

The first defect we will notice is of frequent recurrence; it is a general obliteration of the forms of the subject in an *opaque film,* which prevents them from being clearly distinguished, in whatever direction they may be viewed. This is termed "fogging," and is caused in a variety of ways. It may result from the unskilful use of the developer itself; if it is of too great strength in warm weather, when it should have been reduced in power by the addition of distilled water and acid, fogging will ensue; or, at a more moderate temperature, prolonging the time of development beyond a certain limit, will cause the same blemish. If weakening the solution in the one case, and shortening the development in the other, does not remedy the evil, the nitrate bath must be tested for alkalinity with *reddened* litmus or turmeric paper.*

"Fogging," its causes.

Over-strong developer.

Nitrate bath alkaline?

* Litmus paper, when used to test for alkalinity, is first reddened. This is best done by taking out the stopper of an acetic acid bottle, and holding a strip of the paper in the *fumes*

If its condition is found satisfactory, *i. e., neutral* or *just* acid, which will be seen by its allowing the reddened litmus paper to retain its colour, the fault is not there. If it restores it to its former tone it is *alkaline*, and a drop or two at a time of the dilute nitric acid, see page 281, must be added; *testing between each change* with the *blue* paper, so as not to exceed the quantity necessary, which will be when the paper is tinged with *red*. Stir with a glass rod during the time, that the drops of acid may be equally distributed *throughout* the bath solution, and their action not confined to the mere surface. FOGGING. Remedy if found so.

When there is only a *very slight* tendency to fog, it is better not to touch or alter the bath; by using a more highly coloured sample of collodion perfect clearness of definition will be restored to the film, whilst at the same time every plate of such quality of collodion that is dipped will tend gradually to displace, more and more, the small tendency to alkalinity existing in the bath. *Very slight fogging.*

Indeed, with such a combination and balance of properties, an *acid* collodion and a *neutral* bath, most excellent qualities are produced in the picture; the bath, on the one hand, possessing the power to accelerate the action and delineate the difficult colours or obscure radiations from the subject; whilst its inclination to fog is bridled by the acid state of the collodion, which keeps the Excellent combination.

inside; it will immediately change from blue to red. Actual *contact* produces a less sensitive test paper, its texture being completely saturated with the powerful acid.

FOGGING. general definition of the plate and its darks and half-darks bright and clear.

Acetic acid deficient in strength. Should the bath, when tested, be found in good condition, the fault may be with the acetic acid; if it is deficient in strength it will not moderate sufficiently the action of the pyrogallic or iron in the developer: on adding about a sixth to one quarter more than its original proportion to the solution clear plates will be obtained; for extreme heat use citric acid. When not arising from these sources, fogging may be caused by *diffused light* having acted upon the film either in

Diffused light, and reflexions. the operating room, the slide, or the camera, or from the reflexion of light from *bright surfaces* in the studio, or portions of sky acting directly on the lens. Carelessness in the operator, viz., handling the nitrate bath dipper with dirty fingers, contaminated by contact with the developing sol. or fixing hypo, will creep down the dipper into the bath solution, any messing or allowing splashes of chemicals to fall into the bath, *must be avoided*—it should be kept rigorously covered with a loose cap.

An old bath. An *old bath* has occasionally a tendency to fog, from the accumulation of organic matter and presence of oxide and *nitrite* of silver; the best remedy in this case is to replace it by an entirely fresh one.

Over-exposure, Lastly, and more frequently than any of the preceding causes, *over-exposure* at *large apertures* of double lenses is a fertile source of this imperfection, especially when used in the open air and their surfaces carelessly exposed to the action of diffused light. This especially applies to the por-

trait, orthoscopic, doublet, and rapid rectilinear. *Shade the front of the lens more completely.* One general line of demarcation exists in fogged plates, which materially assists the operator in discovering the origin of the evil; it is that when fogging proceeds from impurity in the chemicals it is *on the surface*, and is removable by gentle friction with the finger. If it has been produced by over-exposure or diffused light it is *in the body of the film*, as much as any portion of the subject itself, and is incapable of removal.

INSENSITIVE

Means of ascertaining.

The next blemish we will notice, is the direct opposite to the fogged appearance on the plate: it is the insensitiveness evidenced by the too great quantity of *bare glass* seen on the plate; this is caused probably by *acidity* of the bath, which must be tested for it; if there, its presence will be denoted by the greater or less degree of intensity of the *red* colour which it imparts to the litmus paper, and according to the proportion, so must the quantity of the alkali, applied to rectify it, be regulated. Some operators recommend ammonia for this purpose; the writer advises drops of a solution of carbonate of soda, dissolved in distilled water, to be used in preference, having found it in practice give much better results. It must be applied very gradually, and the test-paper and stirring-rod used as mentioned before.

Insensitive film.

Bath tested for acidity

If on testing the bath its acidity is not considerable, and the operator has been working it with a rather highly coloured collodion, instead of meddling with the bath the *balance* before mentioned can now be restored in the contrary direc-

Over-iodized collodion.

RETICULATION. tion—namely, by using the most *neutral* sample of collodion at hand, which will be found as efficacious in restoring sensitiveness, and giving delineation of forms in the bare portions of glass, as the acid collodion was in clearing the obscured plate.

Too short an exposure. If the bath is not in fault, the *exposure in the camera* has probably been of too limited duration, or the *diameter of aperture* less than the quality of light would bear; increasing the time of the first, or enlarging the other, will entirely alter the character of the succeeding plate.

Waviness. Reaminess, or wavy marks, of uneven thickness in the film, are most likely to occur in thick viscous samples of collodion, which are difficult to get off the glass with sufficient celerity; in hot weather *all* collodions will be apt to have this defect, owing to rapid evaporation of the ether in manipulating.*

Fig. 50.

Collodion too viscous.

This unevenness is most offensive in large flat tints, backgrounds, &c., with whose perfect appearance it of course greatly interferes, but it is highly detrimental and objectionable in *all parts* of a picture, for as the *thickness* of the collodion

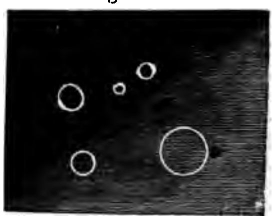
Consequences.

* Cadmium-iodized samples are most apt to become thickened; indeed, it is probable that one cause of the *superior sensitiveness* of this class of collodions is due to the spongey thickening or opening of the structure of the film, which becoming in excess must be moderated as directed.

film is *doubled* in such parts, *no treatment* which will apply to them will be successful for the rest, and *vice versa*. If the film be detained until *they are set*, the other parts will be dry and insensitive; if they are immersed when the rest of the film is ready, from not being dry *they* will be still unset, and being soft the other portions of the film will drag them, and they will be full of crapey marks, which conditions occurring across features, &c., are very destructive to the picture. In warm weather, especially, the state of the collodion must be carefully watched, and as it thickens by evaporation, *newly washed* ether must be added until the necessary fluidity is attained. **WHITE RINGS.** **Must be diluted, and how.**

Small white circles, as given in the cut, appear in the subject. This blemish is caused by the operator elevating the mouth of the collodion bottle *too far from the glass* in laying the film; the action established in the liquid, by the minute bubbles created, remains after they may have dispersed, and their traces reappear in the finished work in the manner shown. If care is taken to *depress* the mouth of the bottle sufficiently, before beginning to pour the collodion, these marks will not occur. **White rings appear.** **Not to pour too high.**

Fig. 51.

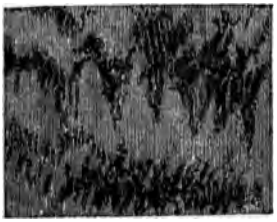


Peculiar *serrated* marks are caused by a greasiness or scum on the surface of the bath, which attaching itself to the film, slides down it **Serrated marks,**

SPOTS. when put to drain. This defect disappears after dipping two or three plates, showing that they have exhausted the impurity and cleansed the surface for succeeding ones. This blemish is entirely consequent on the contact of gutta percha with the bath solution; *all other precautions* being taken to avoid the presence of organic matter, dust, &c., it is unknown in a glass bath.

caused by greasy scum.

Fig. 52.



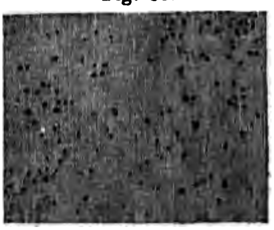
Spots of transparency,

Spots are of two kinds; those of defective action, leaving bare glass, and printing black, are caused in the following manner.

due to *nitric acid* and Tripoli,

Tripoli and *nitric acid,* recommended sometimes for use in cleaning the glasses, adhere most tenaciously to their edges, and if present will, when the plate is dipped in the bath, be dispersed by the solution though it was intractable to water, and settling on it, *and on succeeding* films, causes spots of bare glass to appear. Prepare them as directed, article "Glasses," which is quite sufficient. A film that has been kept too long in a *new* bath, or that has been *delayed* before exposed in the camera, will thus become dry, and the collodion being acted upon by the nitrate of silver,

Fig. 53.



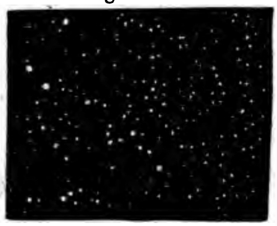
or action of nitrate of silver.

numerous minute spots are eaten into its structure. COMETS.

The contrary appearance — that is, spots of opacity on the plate, printing white—is produced by dust settling on the film in certain stages of adhesiveness of the latter, and not forming "Comets," but spots, by minute centres of increased action. By the film being laid from a highly coloured sample of collodion, and excited in an old bath which has become over-iodized; lastly, and most frequently, by too prolonged development of an under-exposed plate, and using excess of drops of bath solution in the developer, the effect of which is to cover the surface with minute specks of concentrated deposit of silver.

Spots of opacity, from dust, over-iodized bath. "Drops" in developer.

Fig. 54.



Photographic "Comets" are defects which bear a remarkable resemblance to the forms of their prototypes; they are caused by particles of dust in the atmosphere of the developing room, which, descending on the wet film, reappear in the picture in the shape of spots, comets, &c., by the action for which they serve as nuclei; when they arise from this source, the tails, &c., stream from them

"Comets," when vertical, caused by dust.

Fig. 55.

COMETS. in a *vertical* direction as they lie on the *surface* of the film, and are caused by action in the bath liquid, retained by them, flowing downwards.

Remedy. Greater care in *clearing away dust*, &c., will prevent their being seen on the plate. They will

Resulting from collodion. likewise arise from an inferior quality of collodion; from carelessness, with a good sample, in not decanting the *upper part* of it from a large *stock bottle* into a smaller, thus leaving all impurities of former manipulations behind; by using the collodion *immediately* after iodizing; or from not wiping, with sufficient care, the necks of the bottles from dried fragments of collodion or dust, or from any flue, &c., off the glass-cloths, adhering to the surface of the plate. When they are *in* the collodion itself

Fig. 56.

Differ in their form. may be known by the tail-like appendages, &c., taking a curved form of direction, consequent upon the rotary motion imparted to the liquid in laying the film; whereas those dependent on the action of substances merely resting *on the surface* of the film, have direct vertical lines of *drainage* action.

Lines crossing the plate, Straight lines, of varied intensity, crossing the plate from side to side, are caused by any pause or hesitating movement with which the dipping

caused in dipping. of the film into the nitrate bath may have been accompanied. As has been mentioned, the action should be firm, prompt, and consecutive.

STAINS.

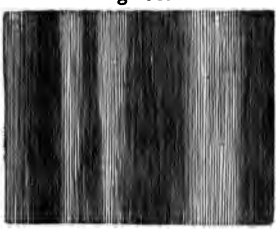
Marks often appear like small beards of light *following the forms* of the high lights of the subject, and streaming downwards from them in the direction in which the film stood when exposed in the camera. This defect is caused by the plate not having been sufficiently drained before exposure; the action is caused thus: The rays of light which delineated the fingers, linen, &c., in the image, were diverged and reflected by the descending liquid, and possessed, in the *immediate vicinity* of the high lights, sufficient power to impress an action. Remedy—to obtain a clearer outline, drain the plate more before putting it into the slide.

Fig. 57.

Defective drainage marked in the camera.

The marks do not attach themselves to the forms in the picture, but are seen as a parallel streakiness of various intensity and width across the picture.

Fig. 58.



In dark room.

Streaks, how caused.

These appearances may arise from three causes, and the following tests will enable the operator at once to decide to which he should refer them. The subject was taken in the camera, of "landscape" form, but the marks appear in the contrary sense. The defect was in the dark room; dif-

STAINS. Diffused light. fused light, some crevice, or insufficient yellow blindage, were the cause—that is to say, if they are incapable of removal when the film is gently rubbed either with cotton wool or the finger.

Impurities in bath. Marks similar in appearance to those just described, but appearing in the sense in which the film stood in the nitrate bath are due to alkalinity or nitrites, or some impurities in the nitrate bath, and are often met with in an old bath, in which organic matter in one shape or other is present. They may at once be perfectly distinguished from the preceding defects, which are similar in appearance, by being entirely on the *surface* of the film, and capable of removal by friction.

Deficient illumination; its consequences. Another cause for the appearance of such marks is the following. When working with sensitive conditions of chemicals, if with deficient quality of light, or *small area of size* in the subject to reflect back the pencils of light to the film, the operator should use too small a diaphragm in proportion to either; or that the focal length in the camera should be considerable—the *darks* of the picture are not thrown with sufficient *vigour* on the film to guarantee it from the *general* action, which partakes more of the nature of diffused light than of those distinct pencils of light—with intervals of partial or *total privation of it*—which a more complete action would possess; the consequence is, that the lights are not intense, the shadows are weak, and that the *drainings* of the bath liquid in their course down the film act upon it lenticularly in con-

centrating light, *leave traces of their passage.* STAINS.
But if on testing, the defect arise from the causes given above, the whole will be found *in the body of the film,* impressed by the action of light, and not capable of removal by friction, as some parts would be if caused by impurities in the nitrate bath.

Smears, origin.

Distinct *smears,* with fainter deposit on them, are visible across the subject. They are probably caused by drops of saliva, in blowing the surface of the glass, or by perspiration on the hands of the assistant who cleaned them, having found its way first to the clothes, and from thence to the surface of the glasses. The only remedy, in warm weather especially, is to have a good relay of white cotton gloves for him to use.

Marks of drainage,

Marks at the top and corners of the subject—which in the camera was the bottom—arise either from the film having been too little drained, and the accumulation of bath at the bottom during exposure — or from neglect in blotting out the slide between each picture. Both of the above will be aggravated, if, in taking the slide from the camera, it is not carried in the same sense in which it stood, but tilted or *reversed;* or if the flap, after the picture is taken, is too *violently closed,* which has the effect of splashing the liquid collected in the groove upwards over the subject. As with

Fig. 59.

in camera various.

STAINS. prolonged study, the "collodion back," or holder, becomes sodden with bath solution, having to work long and much at one time, two or more backs and inner frames will tell in the improved results.

Defective slide. A mark of greater light occurs along the whole of the bottom of the subject.—The light has got in at the *top of the slide* whilst the film was exposed, showing the necessity of keeping it covered with a cloth whilst in the camera. A margin of insensitiveness, *i. e.*, bare glass, sometimes above half an inch wide, occurs all along the top of the subject—this generally happens most when long exposures are necessitated, as in interiors, &c. The cause is the accumulation, at the bottom of the film during exposure in the camera, of a band of drainage which obstructs the action on the film. Drain more closely, and *connect* the pieces of blotting paper at the corners with that behind the glass, so as to attract, or suck off, the super-abundant moisture. The subject has a vigorous deposit on the lights, but the *shadows* are too much filmed over to be bright and telling. It cannot be over-exposed, or the lights would not be so vigorous; it most probably, particularly if working with a double lens, arises from diffused light or reflexions.

Diffused light.

It would doubtless be more advantageous that the lens and camera should be so enclosed that the lens, through an aperture, should see *only the subject*, thereby avoiding all reflexions from surrounding light objects and giving the purest definition of which it is capable; but this, in

Reflexions.

practice, especially out of doors, is found troublesome, and loses much time. STAINS.

A much *larger and deeper brass shade* than is usually sold with each size of lens, diaphragmed or lined with *black cotton velvet* (a great absorbent of light) answers every purpose; and has the advantage of allowing the operator much more freedom of action in placing his camera, whilst the shade being *on the lens,* follows its movements; when it may be necessary to shift its position in the field, by altering the sliding fronts. Remedy.

Stains of development are, in the earlier part of the photographer's practice, very annoying; the most frequent are those of *inequality of action,* caused by unskilfulness in not covering *at one sweep* the whole of the plate, or of not *keeping the developer in continual motion,* and thus allowing its greasy streaks and stains to impress their image on the film. Stains of development. Unskilfulness.

Fig. 60.

Using the solution of too great strength will mark a sensitive film by its sudden and violent action, and the impossibility of evening it quickly enough; lastly, using too *small a quantity,* in proportion to the superficies of the film, is sure to create stains from its inefficiency to cover the extent of surface. Over-strong solution.

Patches of insensitiveness arise in two ways, but may each be distinctly referred to its origin. The first are caused in the development, by the Blank patches.

STAINS. Silver deficient in film. operator having poured the solution continuously on *one portion of the film*, instead of distributing it all over. The result has been that he has washed away the silver, which should have formed the image, from that part, and a bare patch is seen in the film; but when arising from this cause there is a remedy. Add drops of bath to the developer, and tilting the plate, apply it neatly to the deficient portion, in which the subject will *immediately* appear, and if done skilfully, not allowing the other parts to be strengthened, it will not be perceived in the finished picture,—the same sort of appearance results from keeping the film too long before dipping it in the bath, especially in hot weather; but there is one appearance which at once marks the difference of the cause, namely that when arising from this source, iridescent tints accompany the mark, which in the other were not seen, and the application of the nitrate drops, the effect of which was *instant* in the former, is powerless in this; the only remedy is in greater promptness with the next film.

Remedy.

Or delay in dipping it.

No remedy.

Dipping too soon. The defect caused by the opposite treatment, namely, dipping the film *too soon*, makes itself visible in *thickened* edges of insensitiveness, called "fringes," on the pouring-off margins of the plate, and a general rottenness, reticulation and crapeyness of the film, which will probably tear up with the action of the water. Reticulations, likewise, are the effects of breathing over the glass, or neglecting precautions in damp weather; *water* is thereby added to the collodion. This is the reason why, in inferior or unskilfully

Effects of moisture.

prepared samples of collodion, reticulation is a frequent blemish,—the alcohol and ether contain *water*, and we thus perceive the necessity of the caution given for their preservation, in perfect order, in small bottles. STAINS.

Hypo stains are of the most formidable and hopeless description; generally traversing the whole plate from the corner where a *finger or thumb unwashed*, after the development and fixing of the last subject, came in contact with the film—caused by messing. *Continual* use of *clean water* and towel (no soap) is necessary in operating. **Hypo stains.**

We have thus examined the various causes of failure in the *manipulation* of the collodion process, and although many precautions may have been more dwelt upon than their nature would apparently warrant, such minute details are *entirely necessary*, and if the reader will only *strictly adhere to them*, he need never doubt that in taking up a subject he will be secure of an *unblemished negative*. ***Minute* precautions *ensure* success.**

PART IV.

SUBJECTS;

THEIR NATURE AND TREATMENT.

PORTRAITS.

Interest of, and reality.

PORTRAITS.—There is no application of Photography which is more interesting and popular than portraiture; there is likewise none in which many difficult, and sometimes antagonistic conditions, require to be nicely balanced and fulfilled, if a perfect result is to be anticipated. When this has been successfully accomplished, and *due artistic feeling* infused into the arrangement and position of the sitter, nothing can exceed the interest possessed by a picture which is the *actual reflex* of the person represented.

Dimension important.

DIMENSION is a most important point to consider in photographic portraiture. The exigences of the lens prevent us attempting many sizes that would be desirable, and the artist who undertakes large portraits has great disadvantages to overcome. The focal length of the lens employed is great, and its action slow, and the sitter's countenance which, had it been taken rapidly, would have been lifelike, sparkling, and intelligent—no matter what his good looks or otherwise—becomes leaden, vapid, and indeed, loses its resemblance to the original; for the soft and mobile parts of the face, round the mouth—which is the chief seat of expression—have so drooped that

Rapidity.

Consequences of slowness.

their very form has altered during the sitting. PORTRAITS.
Thus photographs which have been attempted, approaching *life size*, have been most abortive and disagreeable, and heads of three and four inches have not yet been obtained, with the *figure and hands* in the picture in fair focus and drawing, and when the *head alone* has been given, the operator has been obliged, in order to obtain any degree of rapidity, to use too large an aperture, and the *line* of correct focus traversing the face is, on both sides, in immediate contact with distorted forms. Life sizes.

When it is desired to take heads of *this size* it is useless to attempt the hands and figures; the face must occupy the *central* portion of the lens, and, thus treated, heads of study, &c., can be obtained up to four inches or so. It is at these dimensions especially and those approximating to them either larger or smaller, that the new portrait lens of Dallmeyer shows its superior capabilities, and becomes most valuable to the photographer; giving a general fleshy softness to the features in lieu of the metallic, hard appearance, and by increasing the depth of perfect focus. Head alone.

The *largest size* at which a portrait can be undertaken, that shall include the person and hands, is a head about two inches in dimension; and we now attain a size which, although *difficult and exacting*, permits us more freedom of action in the composition of our picture. Lenses of four and a half, five, and six inches *diameter*, and *focal lengths*, varying from fifteen to twenty-four inches, are required to execute this class of pictures, and the Head, hands, and person.

PORTRAITS. diaphragm must not be more than one half the full diameter if good qualities are desired in the subject, a six-inch lens is quite capable of giving

Full lengths. the *full-length* figure and accessories with such a head, but the feet being liable to appear enlarged, *three quarters* is more recommendable, thus

Conditions required. avoiding that disfigurement. Pictures of this size cannot, however, be undertaken in unfavorable light, as it would then be necessary to enlarge the aperture, and the correctness of drawing would

Exposure necessary. suffer. The time of exposure required will be nearly sixty seconds. The next dimension is of one inch and a half to the head; this picture can either be obtained by using smaller lenses, or retiring the same ones further from the sitter; the latter mode is the better. At this size the *full-*

Portraits. *length* portrait can be accomplished, without distortion of the lower extremities, and *groups* of two, three, or more persons, in the same picture, are capable of being executed. As the increased area of the subject reflects more light to the lens, more rapidity of action, rotundity and intensity

Groups. become perceptible, and with *groups* of figures, pictures of sixteen or twenty inches long can be successfully undertaken. For single full-length figures twelve inches by ten; if three quarters, twelve inches by ten, or ten inches by eight, are suitable dimensions. It will be perceived that the qualities of focus and drawing in the picture have become more perfect, as the size was dimin-

Data for dimensions. ished from the last, and in this dimension we may consider that we have fair average of desirable qualities. As much *importance in size* as can be

photographically attained, without sacrificing correct drawing, and from the power of depicting the whole of the person adding materially to the interest and value of the representation. PORTRAITS. Correct representations.

As the focal length in the camera will have diminished *with the same lenses* in retrograding from the object, we shall, at this size, gain about a sixth in time of exposure with the same apertures; or if the planes of distances in the subject are not difficult, and we wish more rapid action, the diaphragm may be slightly enlarged, and the exposures to be anticipated in the best conditions of light will be from about thirty to forty seconds. Rapidity increased.

The next gradation is to heads of one inch in size. We now enjoy some latitude in points which in the larger sizes have been difficulties to contend with; but, on the other hand, we approach dimensions which are deficient in importance, and incompatible with many requirements. The same arrangements of composition can be made, and the appropriate sizes will be ten by eight in full length; eight by six in three quarters; and six by five in half length. We can now reduce the diameter and focal length of the lens employed; three inches and focal length, ten inches is the proper size to use to works of this dimension—diaphragm about two inches—time of exposure about twenty seconds. Smaller sizes. Appropriate dimensions.

The "Carte de Visite" is the smallest size it will be necessary to notice. The great popularity it for so long a period enjoyed shows that the qualities it possessed must have largely satisfied Carte de visite;

PORTRAITS. the taste of the public. The time of exposure, depth of focus, completion, delicacy, and rotundity facilities, of the image it possesses, are qualities which are only obtained with the greatest difficulty and under the most favorable circumstances in larger works. The damaging condition was this—that from the extreme facility of their execution they became extremely commonplace, and that when the photographer had the talent of arrangement drawbacks, necessary to compose a *picture,* the time so occupied would not be repaid by the small charge customary, whilst the public, entirely ignorant—as a mass—of art principles, was equally delighted to find itself depicted as abiding in cockney Gothic interiors of a cathedral character! bought by the square foot of some dauber, with vulgar and absurd accessories—as it would have been with a and merits; higher grade of representation. Many very charming works may be selected from the mass—"rari nantes"—in the ocean of mediocrity, which show that "small sizes" are, as a rule, the thing to attempt photographically. The carte de visite may be divided into four distinct classes—the head only, of about one and a quarter inch in size; the half length; three quarters, and full. The first, unless executed by a very first-rate operator, is largest proportions, apt to look distorted, coarse and exaggerated, but has the advantage of giving details of the countenance—sometimes too much so indeed—of interesting individuals. The instrument proper to take such pictures is a 3¼ double lens, 10 in. focus; they are often taken with less diameter, but suffer in consequence, as the lens has to be

approached too near the sitter and is "strained." The next size appears to the writer to offer the greatest advantages; the head is as large as in the so-called "cabinet" size, the hands can be included without distortion, and sufficient of the body to give interest—for six and eight in focus lenses are the proper ones to employ, and of the best makers —considerable rapidity is gained over the ten in focal length.

PORTRAITS. diminishing,

The full-length size is executed with lenses of two inch, to three and a quarter inch-short focus in diameter; according to the space at the command of the operator to withdraw his camera further and further from the sitter. It is in all cases better to do so, to the extent the lens will allow; to properly fill up the dimension, rather than attempt to take sizes above the power of the instrument by approaching too near the model. Generally speaking an extreme definition, approaching the steely, has apparently been more valued and attempted than artistic qualities, and the hacknied positions and commonplace accessories have done much to wear out the subject. The dimension being so small, the utmost *finesse* and delicacy—not wiryness of execution—is *necessary* in these works. Development by iron should alone be practised, and the whole scale of light and shade from bare glass in velvets, &c., to opaque white in *small quantities* be utilised in the subject, thereby giving relief, sparkling brilliancy and effect.

smallest proportions,

desirable qualities.

The "Cabinet" size portrait is the last form which appears as a candidate for public suffrage.

"Cabinet" portraits,

PORTRAITS. advantages, It has many advantages, its increased dimension permits a "closer acquaintance with the original" without his being absolutely put to the microscopical examination of injudiciously treated larger sizes; the enlarged scale showing them better, renders it more worth while to pay additional attention to the accessories and chiaroscuro, but at the same time as it shows their excellencies better—when they exist—it most certainly equally emphasises defects; and full lengths, male sitters especially, cannot be rattled off with the indiscriminating facility of the "carte," if absurd want of aplomb or other damaging shortcomings are not to obtrude themselves on the beholder. In fact, the "cabinet" will be found *much* more difficult to bring to an *equally* satisfactory result.

but more difficult.

Rapid portraiture; "Quick" portraits, *i. e.*, heads of expression or of children are an interesting branch of study. They are of course difficult. The *primary necessity* is an appropriate lens. The writer possesses or has possessed all that the optician can accomplish for rapidity of action. The smaller the size the more facile. Short focus lenses are an impossibility beyond a certain diameter, say three or four inches, from the necessary thickening of the glass in their deep curvatures, and if they are not constructed by the *very first* opticians—whose talent they tax to the very utmost to produce them at all—they are absolutely *worthless*. Voigtländer for many years made a lens $3\frac{1}{8}$ inches diameter, with $2\frac{5}{16}$ back focus. This gave a most brilliant image, but was a bulky instrument, very expensive, and with much curvature of field; but

difficulties for optician.

giving an instantaneous picture—a pair were made for the writer at the cost of £70. Dallmeyer's one and a quarter inch diameter three and a quarter back focus—first made in 1860—was a great advance. It is also instantaneous in its action, of very small bulk and price compared to the last, and from its smaller diameter the lenses can be made thin and thus permit the passage of more light; the results of their use are doubtless well known to the reader. Dallmeyer's No. 2 c is on the whole the most admirable instrument yet constructed as an "*extra-rapid*" lens; its diameter is two and three quarters inches with a back focus of four and a half; on the original Petzval construction. It is one fourth more rapid than the $3\frac{1}{8}$ Voigtländer above cited, gives a larger picture—four and a quarter by three and a quarter inches—its field is flatter and in it the *judicious* limit is probably attained of size in construction of this class of lenses. With it portraits of children half length, head half inch, can be successfully accomplished instantaneously, in *good* studio light; it is a most perfect instrument. Voigtländer made for the writer a pair of capital lenses $3\frac{3}{16}$ in diameter six inches back focus, which have been extensively applied to nature and which size can be highly recommended for its excellent qualities as a rapid lens—with a two-inch central diaphragm this lens gives a well-defined field of six inches diameter, with little curvature of its field, for a short focus lens. This is a good instrument; with it portraits of children, or of adults under disadvantageous conditions of light, can be suc-

PORTRAITS. Data for lenses; the most rapid, capabilities. Another fine lens.

PORTRAITS. cessfully treated. It is still made by Voigtlander. The $3\frac{1}{8}$ diameter, $2\frac{5}{16}$ back focus, seems obsolete and its manufacture discontinued; having probably been superseded by the more recent invention previously described.

Essays or sketches recommended. It is desirable, if opportunity offers, that the ARTIST should make two or three essays, at small sizes, of the subjects intended for *large portraits*, which will serve as sketches to show the manner that the light and shade, the positions, and the colours introduced, tell *photographically* in the picture.

For ordinary photographic portraiture the customary charge would not of course permit or remunerate for such study of the subject.

Time of exposure; Exact time of exposure is the next condition to consider after dimension, and the effect which its success or failure has upon the picture in giving delicacy and refinement, or coarseness to the features, is so great that it cannot be overestimated. The difference it causes can be seen its great importance; on comparing an *under-exposed* work with hard outlines, sooty shadows, and chalky, *enlarged* features, without delineation of form; and one which has been successful; in which the features its effects on the picture. are rounded into softness by half tones, and the shadows being reflected into, appear silvery, clear, and transparent.

The development of the image requires most careful watching, as if the deposit of silver in the film is too weak, the face and hands of the sitter If correct may be deteriorated, will be *dark*, and if the development is carried too far, or drops of bath are added to the solution

in order to give solidity and brightness to the high lights, a small excess suffices to render them so opaque that they are deficient in half tones, and that, although the exposure in the camera was correct, the injudicious development has so loaded the lights as to give the effect of an under-exposed picture.

PORTRAITS. in developing.

So that we find—besides the composition of the picture, the perfection of the lens and its judicious treatment, and the condition of our chemicals in order to produce a perfect portrait, we must not exceed certain limits in dimension, that our focus must be satisfactory, our exposure absolutely or nearly correct, and our development judicious; and that a failure in *any one* of these requirements will render the finished work unsuccessful. Before attempting to place a figure for portraiture, the operator should be perfectly acquainted with the qualities of his lens, the *size of picture* which it gives at different distances, *the time*, approximately, that different diameters of aperture demand; the degree of *flatness or curvature* of its field, and the depth of *correct focus* which it is capable of giving in the subject; which preliminary study can be better carried out from a life-sized bust, having the quality of immobility for comparison of successive plates, than from the life.

Conditions necessary to success.

Preliminary study;

Its nature.

Having considered all these points we now proceed to take the picture.

The first thing to arrange is the nature and colour of the background, which should be so managed as to produce a *variety* of light and shade, taking care also that it composes properly

Background arranged.

PORTRAITS. with the dress of the sitter; that is to say, that a *black coat* or dress, if placed against a *dark ground*, would be lost, and the head, hands, and linen, appear as *spots;* so if a *light or white* dress is depicted against a *similar* tone, insufficient relief and chalky monotony will probably result;

Its qualities. nor is it sufficient to relieve dark upon light or light upon dark, the result of which would be mechanical. There must be a play and *variety of light and shade* in the background which will give ARTISTIC qualities, and which, if judiciously managed, will make the interesting points of the figure or costume salient by opposition, and withdraw from the notice of the spectator any which may be disadvantageous. All this can easily be managed by shading parts of the background and

The sitter shaded. of the sitter's costume. There must be a projecting shade of blue calico, or white muslin, over the head of the sitter, which serves three advantageous purposes; namely, to afford relief to his eyes, to produce *gradation* of shade on the background, and more especially to prevent light from arriving in a vertical direction on the head and face; which would give a snowy appearance on the hair and too heavy and dark shadows under the features.

Arranging the camera, Before the sitter arrives let the camera be *in situ,* at about the requisite distance for the size intended, and the centre of the lens at the height of his chin, which may have been previously ascertained; if accessories are introduced let them be *analogous to his position or vocation,* and not of the common-place kind too often seen: it will

be well that they should all be previously placed in desirable focus, and their effect studied in the camera. The head rest for standing figures is the one described (fig. 40), page 89; or a modification of it; it must be wedged under the stand to prevent any tremulous motion. On the sitter's arrival endeavour to put him as much as possible at his ease; turn the fork of the head rest on one side; let the sitter *stand* upright (be sure he does not lean) against the pad of the back rest, which should touch him firmly, and against which he may turn round, as on a pivot, and change his position till advantageous. This arrangement secures the *hands, figure,* &c., from movement. Now retiring from him, your eyes strictly in the line of the *centre* of the lens, observe the picture —improve, if possible, the position of a hand or the turn of the head—note, that any movement of the sitter's head should be *very gradual,* small alterations making in the camera much difference; avoid all appearance of effort in attitude or expression—quiescence or repose is the best; at all events let both be as natural as possible. Now go to the camera, the lens at full aperture; see, on focusing *just* on his eye, how the arrangement of the subject and figure and *the angle* of the camera agree with the focus of the mass of the picture; the head, of course, should be pretty good; look to the hands, and if one or both of them are in bad focus alter their position: the nearer the picture is made correct at *full aperture* the better. The accessories can, of course, be moved in any direction that will better their focus.

PORTRAITS. and head rest. Studying the composition. Gradual changes. Lens at full aperture. Placing the accessories.

PORTRAITS. When the composition is satisfactory come to the front, place the fork of the head rest *gently but exactly* against the head, screw it firmly, being careful that it is in such a position as not to show in the picture. You *must have a skilful assistant,* capable of preparing the plate; he should so have timed his arrangements as to be now ready, and on a signal given entering—which will be as well behind a screen, not to disturb the sitter—having previously put in such diaphragm as the nature of the subject and the light at the moment will dictate, and covered the lens, he puts the collodion slide in its place, uncovers the film, and remains ready to remove the cap; turning his back to the sitter if seen by him. Now quickly, as the collodion will not wait, give a rapid scrutiny to the drapery and hands, which if well are better not fingered about, as they become mannered and stiff. Do not let the sitter pass his tongue across the lips, as many have a habit of doing at the last moment, the reflexion of light on the *wet* surface gives white not colour (see LIGHT, page 12). Some portraitists advise the direct contrary, let the reader try both methods. It is well that his expression should be animated by conversation to the last moment.

Preparing the film,

and diaphragm.

Final scrutiny.

Animation desirable.

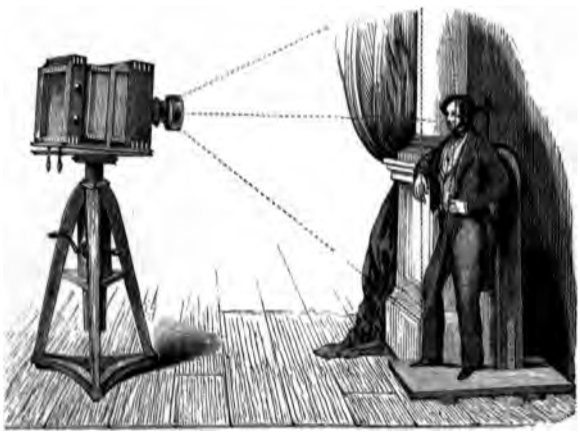
The picture must be commenced with the desired expression; having got which *instantly,* but gently, uncover the lens. Watch well the quality of the light; blue sky, with white cumuli, are what is most desirable; north to west the quarter of the wind; eleven to two the best time of the day. It is better to turn away from the sitter,

The qualities of light.

as persons looking at him may derange his expression. PORTRAITS.

For such a picture as the foregoing, the *flatter* the field of the lens, the better, as the accompanying illustration will show: Observe on Standing figure.

Fig. 61.



focusing to the eye, the line of principal focus strikes precisely the front of the chest, the head, &c.; had it been more curved, the hands and person would have been *out of focus*, resulting in the distortion and enlargement of those parts. If accessories are introduced on a table, &c., the diaphragm will be exacting; the advantage of this three quarter form of portrait, as against full length, in photography, is that the extreme lower part, which being executed by the margin of lens is the weakest in definition, falls on the middle of the sitter's legs, where in the costume of either

Flat field of lens desirable.

Lower parts distorted.

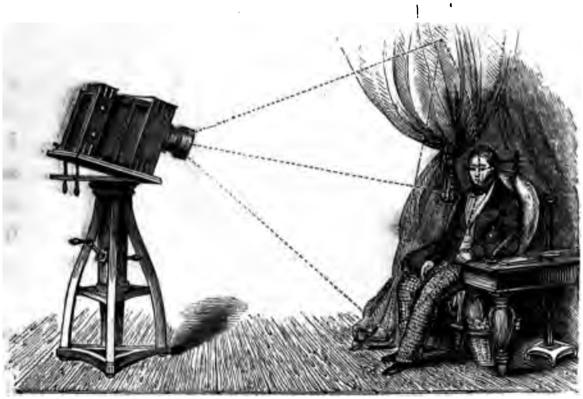
PORTRAITS. sex there are no forms to demand careful delineation; indeed, whether the folds of a robe, or the unpicturesque trowsers, it is as well, and throws more interest into the head, that the lower parts should be as it were sketchy; not so if it were a full length, the feet would appear enlarged and ugly under such conditions.

Better omitted.

Sitting position.

Now, in treating this same class of portrait in a sitting position, two conditions differ, and

Fig. 62.



must be remarked: first, that the camera should be rather higher than it was placed for the standing figure, and *slightly* "dipped," whereby it will take a line of focus more accordant with that of the figure, as shown in the cut. And next that to treat seated figures, a lens of which the field is *less flat* is *positively* better, since the curve includes more advantageously the knees and hands, in this position, than the flatter field

So flat a field not desirable.

of the former lens. It has been recommended to put a sheet or white surface on the ground, at the feet of the sitter; a very disagreeable light in the eye is the result, giving a sinister expression to the countenance, besides being very fatiguing to the sight of the sitter. It is much better to work with a *lower angle* of light on his person, and thereby, and by its being sufficiently diffused, render the shadows on the countenance less harsh. PORTRAITS. Reflectors.

The best light for portraiture, in fine sunny weather, is the quarter of the compass from N.W.—N., to N.E., and *to the eye* the effect of light and shade on the sitter's face should be so gentle that the shadows are delicately defined; the collodion film being very sensitive, appreciates their gradations more readily; if they were seen on the face as they would be desired in the picture, they would appear in the finished work with dark and Carravagio-like effect, ill fitted for portraiture, and only permissible in heads of study. In dark dull weather when *no good results* can be obtained in the above light, the direct opposite, viz., S.W., is the direction to work from. The most advantageous light. Appearances described.

THERE IS NO RESULT equal to that which is given by the *perfectly successful* treatment of the lens, &c., in its *pure and untouched* state. In a variety of ways, however, the necessity will arise for touching upon the negative; the following are the most general causes: light grey or blue eyes. Besides *profile* treatment, which is the most judicious for such subjects, the pupil of the eye should be *most carefully* and skilfully touched Retouching.

PORTRAITS. Expedients

with a small sable brush just dipped in a solution of cyanide. This must of course be done before the negative is varnished, and it must be *carefully* washed afterwards; no scraping can equal this treatment. The high light may now be added in black varnish or vermilion, zinc white, &c. Under-exposed negatives, or harsh lines on the sitter's countenance, may be worked over very extensively, *using a magnifying glass,* with either of the following: Take a piece of glass with a coarsely-ground surface, rub on it a "Faber's" black-lead pencil, add spirits of turpentine, thoroughly mix, better *grind* under a glass "muller," stipple and soften the asperities. Another method: remove old films from glasses in water, as directed, page 91; recover them by percolition through linen; *when dry,* treat them as above in every particular. A successful portraitist at Vienna is said to be very clever at this "touching up," but, however skilfully all this sort of thing may be done, the result shows the means employed, and, to those competent to judge, is, as before stated, merely an expedient which, whenever possible, should, by proper treatment, be rendered quite unnecessary.

for faulty negatives,

No "*skilfully retouched*" (?) picture could for one moment compete with the qualities displayed in the large vignette heads of T. R. Williams, or other successful photographs. Modifications of the above manipulation are applicable to larger portions of the picture, namely, weakening by cyanide the too dense deposit on portions of background, accessories, &c., thereby "keeping them down," or by a

opinion thereon.

general "tint," of greater or less opacity, lightening portions or masses, thus giving "breadth of effect." These latter treatments, equally applicable to landscapes, interiors, &c., &c., as they do not interfere with the *drawing or definition given by the lens*, are, if skilfully managed, unobjectionable; in many cases, even desirable, improving light and shade, massing too minute detail, giving "breadth of effect," and artistic qualities. PORTRAITS. Judicious tempering.

In portraiture the student should refer to prints from the works of Velazquez, Titian, Vandyke, Rembrandt, Rubens, our own Gainsborough, and Sir Joshua Reynolds, eschewing the affectations of the periwig school of Mignard and Lely. If he really can do anything, this study will surely bear fruit and make itself felt in his works. It has lately been matter of observation how much the study of art principles has enabled Mr. Adam Salomon to prove the fallacy of the idea that the photographic representation is a mere mechanism, dependent upon the lens and the box it is mounted in, whereas in this department of it, and in all that is arranged and composed from the human figure, the will, intention, and idiosyncracy of the producer makes itself felt as completely as though he were at work with palette and brushes. The great masters. The camera vindicated.

TAKING A GROUP OF SEVERAL FIGURES IN THE STUDIO.—Before attempting this, the most difficult operation in Photography, it is necessary to study several preliminaries. It will be highly desirable that the artist should make a sketch of the proposed composition; always bearing in mind, in so doing, the exigences of focus. If he Previous sketch desirable.

GROUPS. be judicious in his arrangements, there is nothing whatever to prevent his having the satisfaction of seeing his conception perfectly realized by the camera, with such delicacy of finish as Nature's handling is alone capable of.

Dimension studied. His sketch being made, he must now decide at what size it will be judicious to execute it, not forgetting that certain distances in *depth,* from front to back in the subject, will only admit of equivalent limits in the dimensions of the picture; and that by attempting *large sizes,* with *deep* compositions, defective definition will be sure to result. He must remember that focus is the pencil's-point in Photography, and that it will be impossible to make a perfect work if it has been neglected.

Lens selected. Having selected such lens as may seem best adapted to the dimensions proposed, of which an approximate guide is given at the end of this section, he must fix his camera opposite the place where the subject is to be composed, and at such distance that the area necessary to contain the intended group just fills up the space allotted to it in the camera; he must take care that the camera is at right angles with the subject, and he Preliminaries. must now ascertain the line of principal focus at full aperture of his lens, through his picture, taking a point near the centre for the most interesting objects in his composition, as there the correct definition of his lens will be greatest; he will place numerals, as described at page 57, on the curve of the focus, and marking the results on the ground, be enabled at once to place the still- Subject arranged. life, background, &c., and to arrange for the

GROUPS.

figures in the most favorable situations, to comply with those exigences by which he is restrained; remembering, "Ars est celare artem," and that no traces be observed, in the resulting picture, of his careful management. As he proceeds in the arrangement of the composition, it will be well for him to refer continually to his camera, *at full aperture,* to see how the important parts of his subject stand relatively to the principal focus; noting, however, that the focus will be deepened and the definition improved, when he shall afterwards put in such diaphragm as may be judicious. It will be well that the background should be less perfect in definition than the principal objects in the picture, but not too much so. If the persons are at hand, who are to be introduced in the composition, or if there is a lay figure and some of the draperies which are to be used, a trial negative may be taken, which will show if the colours are *photographically* desirable, or the contrary; should either some isolated objects in the picture, or larger masses of the composition, require to be lighter or darker, use may be made of the following expedients: first, for *small portions.* Furs, rocks, stones, hair, hands, or complexions, leaves, grass, earth, carpets, &c., may be lightened as much as necessary by a powder-puff, directly applied, or shaken a yard or so above them, so that an atmosphere of extremely minute white particles shall settle on them—chalk or whiting may be lightly smeared on iron work, carved wood, or other surfaces, &c., or a stiff "hog tool" may be used to those or

Photographic conditions.

Diaphragm.

Photographic sketch.

Expedients to alter parts.

GROUPS. other surfaces with powdered chalk; larger parts may be tinted wet with whiting and lamp black to any tone required; or to darken take burnt umber and lamp black, and apply dry or wet as directed previously.

To change larger masses. If *large portions* of the composition would be better kept down, a blind or curtain, either opaque or semi-transparent, as thin muslin, may be interposed between such parts and the light, and by various trials of such effects on different parts of the composition very fine results may be arrived at. Should parts be too obscure, white paper, sheets, or looking-glasses may be used to throw light and reflexions into the picture. The so-called "daylight reflectors" are useful for this purpose. Arrangements may be made to give the models support during the sitting, without such necessary aids to their steadiness being apparent, or in any way interfering with the freedom and nature of their positions and expressions; sometimes, if the attitude be not difficult, a very small matter will suffice—anything *rigid* that will prevent the *sway* of the body. Having thus sufficiently prepared the subject, the actual execution of it arrives: here the greatest attention will be required that the draperies take a proper arrangement of folds; that the positions of the bodies, heads and hands, and more than all, that the expressions of the countenances are as they should be, for it suffices that a finger be disagreeably placed to spoil the whole as a perfect work; and this, when several figures have to be treated, apart from all difficulties of manipulation, may well

Daylight reflectors.

Final arrangements.

explain how far approaches to anything like satisfactory results are seen in this department of Photography. The size of aperture to be employed with the lens must be regulated by several conditions: the depth of the picture, the quality of the light, the nature of the positions and expressions are the chief points to consider. The conditions which will demand or admit of a diminished diaphragm are—perfection of light, shallowness from front to back of the subject, and positions of an easy character; as for instance, sitting, well supported, and the eyes not turned fatiguingly to the light; such diameters of aperture will always tend to give much greater refinement of definition and beauty to the drawing of the objects represented, but are incompatible with bad or indifferent light, a *deep* composition of picture, and positions or expressions of countenance which the sitters could not maintain without a visible appearance of constraint. All these points having been considered and provided for, it will be better that the sitters should not be retained in their places, until the collodion film is taken from the bath to drain, which will prevent unnecessary and deteriorating fatigue. Of course it is in many respects better that an assistant should prepare the plate, leaving the artist entirely free to arrange the picture; but to show the student that it is not absolutely necessary, it may be stated that groups of several figures have been arranged, the whole of the manipulations performed on plates of some size—16 × 13 inches—and several negatives, with satisfactory expressions, produced

GROUPS.

Precautions.

Diminished aperture.

Increased, and why.

An assistant desirable,

but can be dispensed with.

GROUPS. entirely without assistance, within the hour. The great point in such compositions is to see, before *Artistic* requirements. uncovering the lens, that not a hand or drapery is misplaced, leaving the expressions to the very last moment, when they are satisfactory—of which the artist must assure himself very rapidly—gently, but quickly, uncover the lens; it is better to maintain perfect immobility, and on no account to allow any spectators of the operation, who may readily, by their presence alone, spoil all.

Nature of subjects. It is surprising what a wide scope for the artist exists in this department of Photography; *à priori,* it would be supposed that he would be limited to the mere representation of an angle of a room, with any additions in the shape of furniture, &c., that he could introduce; such, however, Varied and numerous. is far from being the case, a vast variety of subjects, or portions of subjects, as studies, are within the powers of Photography in this department; indeed, it might be said that almost *any* description of group or composition might be successfully represented by means of a little study and ingenuity.

Accessories. Water, rocks, foliage, flowers, plants, fish, game, and any other still-life, analogous to the matter on hand, may be so arranged with the figures that the subsequent observer shall not have an idea that the picture was composed and treated in the studio. By varying the light and shade on portions of the composition by blinds, most instructive and interesting results may be obtained, and such varied effects of *chiar-oscuro* on the *same subject*

would be most useful as studies and appreciated by all artists. GROUPS.

Such pictures require to be executed under the most perfect conditions of all kinds. Two or three hours on the finest days in the year, during the months of April, May, and June, or half July, are the limits to which the light appropriate to such subjects appears to extend. The instruments of the first opticians, the chemicals, &c., in *perfect* order. Data for executing.

Of course, in every way, such pictures tax to the utmost the whole resources of the ARTIST and Photographer, and faults and blemishes—in either department—become salient at this size, and challenge scrutiny, which, at smaller dimensions, would not have occurred, or might have escaped observation. It would appear that at the present time in England no encouragement is met with for such works, as none are shown here. Herr Angerer, of Vienna, however, executes now large groups of great excellence for that refined and art-loving population, and the results are much appreciated by them. At the prices now considered in London a sufficient renumeration for photographic portraiture, it is not at all likely that any Artist—for such he must be to undertake such works as these—would give his attention to them—this is regretable, since with proper means and a reflective and appropriate study of composition, grouping, and back ground, large groups of full length portraits — from personages whose representation and reflex from the life by photography would, both now and hereafter, have great Difficulties. Insufficient encouragement. Interest.

GROUPS. historic interest—might be produced instead of the ephemeral trivialities which, alone representing the first people of our country and era, fill the shop windows.

Dimensions. The largest sizes executed of this class of subjects by the writer have been on a plate of 16 × 13 inches. They are compositions consisting of several figures, accessories, still life, &c., the depth of which from front to back occupied a depth of nearly five feet upon a width of twelve. The lenses used were "Portrait combinations" only, 8 inches diameter Ross, 5½ and 6½ Voigt-

Instruments used. länder, and 6 inches Jamin, and provided sufficient artistic knowledge and study, due time and care, and considerable expense and trouble in collecting and arranging the appropriate accessories, the subjects possible to be undertaken with good prospect of success are most varied and interesting. The next gradation in size, viz., to 12 × 10, opposes fewer difficulties, and at this dimension, if desired, even the landscape single may be used; it has been by the writer on many such subjects, consequently the 4½ "Portrait combination," the orthoscopic, and the triplet equally, or with greater facility. With chemicals, &c., in perfect order the writer has, in forty seconds, in January, taken with a

Results quoted. single lens negatives—"The Baron's Feast," one as an example—in which five figures and numerous accessories were introduced, with 4½ double Ross, 1½ diaphragm; Don Quixote, 13 × 11 inches, a depth of composition for focus of 7 feet by 9 width, in fifty seconds. The smaller sizes, from 10 × 8 downwards, offer greater facilities of every kind

the more and more they diminish in size; they are to be executed either with smaller lenses or, if the locality by its length and size permits, by withdrawing the camera further and further away from the composition; and, as aperture may be enlarged at every such withdrawal, the time necessary for the sitting will be diminished, the depth of correct focus in the picture increased, and less distortion appear, by the greater parallelism of the rays refracted from the lens.

FIGURES.

Variations in size.

RUSTIC AND PICTURESQUE FIGURES, whether singly or in groups, differ from portraiture and subjects of refinement in this important particular, that whereas the latter are obliged to be taken in a tempered light, in order that the shadows on the faces may be softened, and the features as delicately rounded as possible; the whole of the subjects comprised in the title "Rustic and Picturesque figures," gain in character and vigour by being executed in open sun-light, provided that the shadows are treated with sufficient skill to prevent their degenerating into heavy black masses without reflexions.

Differ from portraiture.

Can be taken in open sun-light.

This is photographically advantageous, since the increased power of illumination allows the picture to be taken very rapidly, thereby avoiding the blemishes that it would show in a more prolonged exposure, with sitters often intractable and ignorant. It will be advisable that the artist should give considerable attention to the grouping and arrangement of his materials, so that they may have a *natural* and pleasing effect; the best method for him to accomplish this, is to

Attention to selection and arrangement.

FIGURES. watch a group when they are not conscious of his observation, and when subsequently setting them, or similar figures, for the camera, to endeavour to reproduce what he has previously noted.

So little has yet been seen in this class of subjects, that it may almost be considered untrodden ground, and a rich harvest of admirable material presents itself to the discriminating photographer in every locality. With proper selection, the most interesting and useful studies can be collected, whether by the military and naval services, the tourist and traveller, or the more stationary photographer. It matters not whether the subjects represented be taken from our own fields and shores, or from more distant and, to us, more interesting, localities; the truth and exactness with which they can be rendered by Photography, will ensure their being generally appreciated. What is most requisite is, that the figures composing such groups should have an air of natural occupation, as if in their usual vocations or amusements. When, heretofore, they have been attempted by amateurs and others, they have too generally been shewn as a stolid half circle of gaping figures, intently staring at the lens. Now it must be evident that such a picture can excite no feeling of satisfaction, even in persons of the most uncultivated tastes in art, who are, however, not slow to appreciate the merits of more tasteful selection and arrangement. It is very desirable, and adds much to the interest and instruction of such pictures, if the dwellings, implements of their calling, the animals they employ, their

Form desirable studies.

Taken in natural groups,

not staring at the lens.

Generally instructive and interesting.

trappings, and the vehicles of the different countries, are represented in the same studies as the figures. If thus arranged and treated it matters not whether the harvest-fields or hop-pickings of England, the posadas or sierras of Spain, with their Murillo-like beggars, their trains of dusty mules, and gaitered arrieros, the noisy and many-coloured Zoc of Tetuan or Tangiers furnish the subject, or whether the narrow streets, crowded fountains, or rich bazaars of Cairo and Constantinople are realized, or if the mail-clad warriors of Circassia, the tents of the Bedouin, and the endless variety of picturesque costume of the East are represented,—all are interesting, instructive, and highly useful in many directions.

FIGURES. Suggestions for photographers.

The best lenses to employ for these subjects are, the orthoscopic, the portrait, and the triplet, the first for the large, the two latter for smaller sizes. The orthoscopic lens has several advantages, for this purpose, over the double or portrait lens. For large sizes of pictures, say, 18 × 14, the appropriate orthoscopic lens is only No. 3, a small instrument; whilst a 6-in. diameter portrait combination would be required,—even that would not work so clear and sharp up to the margins of the subject as the above orthoscopic. The writer has executed with all very many groups, the largest on 18 × 14 glass, of one which is probably the best known, "Roman Peasants, a Festa Day," published by Messrs. Fores, of Piccadilly; taken at Rome, in weak sunshine, mid-April, 10 a.m.; moderately fine, inclining to haze,

Appropriate instruments.

Data for execution.

FIGURES. thermometer 73° Fahr.; lens No. 3 Voigtländer's orthoscopic, $1\frac{1}{8}$ diaphragm; mixed collodion, Ponting and Hardwich's old cadmium-iodized; bath *nearly* neutral; Hopkins and Williams's re-crystallized and *fused* nitrate of silver, thirty grains solution; exposure ten seconds, preserves laughing boy's expression; grass and hair *movement*, by wind, not deficiency of lens. Development—$1\frac{1}{2}$ grain pyrogallic followed, when well advanced, with three grains, strengthened with thirty grains nit. sil. sol. The negative, which is the property of the publisher, looks well covered, creamy and dense, and, had it been desirable, could have been made much more so. Medium sizes, 12 × 10, are less difficult, and can be produced either by withdrawing the camera further off with the No. 3, or employing No. 2; the former is better, but for smaller sizes, 10 × 8, 8 × 6, 5 × 4, Dallmeyer's triplet, with iron developments, has been effectively employed, as giving the delicacy of finish appropriate to smaller works; also $3\frac{1}{4}$ ten-inch focus, Ross, double portrait, for when groups of animals and figures, *mixed*, are undertaken, it is more desirable; with $1\frac{1}{2}$ or 2-inch diaphragms, in one to two seconds, numerous groups of animals, buffaloes, oxen, &c., and figures up to the size of 10 × 8 inches have been taken by the writer, and in full sunshine in Italy, one succeeded the other, with no failures from movement and fine blooming negatives; some with Ponting's cadmium collodion, pyro developed, others with Thomas and Hardwich's collodion and iron.

Lenses and chemicals.

Results.

Diminishing sizes.

Data.

Before the introduction of the orthoscopic and

triplet lenses, the old landscape form was the lens employed on this class of subject, but only for set groups of one or two human "sitters"—no animals, as the length of exposure would not have permitted it. A deceased amateur, the late Mr. Grundy, produced, with the single lens, as excellent, artistic and picturesque combinations—generally a single figure with very appropriate and picturesque still-life and accessories, and as well executed as it is possible to desire, on 10 × 8 inch negatives.

FIGURES.

Example quoted.

Few or no travellers or sojourners in the picturesque East have shown, in all these years, what they could do with the admirable material offering itself, ready prepared, to their hands.* It is to be hoped that the precise data here given will encourage them to send to England some pictures of groups clad in the picturesque costumes, armour and arms, to be found in central Asia.

Suggestions.

For large studies of single figures, or groups of two or three ten and twelve inches high, Ross or Voigtländer's 3 orthoscopic one-inch aperture, ten seconds, Hardwich's collodion, cadmium-iodized, pyro developed, gave brilliant pictures of this class.

Large groups of ten or twelve figures, no animals, 18 × 14-inch negatives, 4-inch Voigtländer's orthoscopic, $1\frac{1}{2}$ aperture, Thomas and Ponting's collodion, mixed two or three days before operating, both pyro and iron developed.

Instruments and chemicals.

* Where was the photographer of the recent gorgeous Durbar at Lucknow?

FIGURES. Smaller sizes; desirable, of course, if children or animals enter into them, are more facile of execution. Portrait lenses, $3\frac{1}{2}$ diameter, ten and eight-inch back focus, orthoscopic No. 1; Dallmeyer's triplets, Nos. 1, 2 and 3; rather slower, but give *high finish*—will give rapid pictures; the first two in full sun as quickly as the lens can be uncovered and covered again. At this size *all* to be developed with iron as giving at these dimensions greater delicacy of treatment and finish.

Various lenses.

Dallmeyer's most recent lens, the "Rapid Rectilinear," is well calculated for all sizes of this class of subjects, where a large angle is not necessary to be included. Its merits are—power of being used at a very large, or at *full* aperture, consequent amount of light to the film—meaning *rapidity* and its penetrative power, giving depth of focus. It must be *carefully shielded* from diffused light.

INSTANTANEOUS PICTURES.—If there is one direction more than another in which we may look for greater artistic excellence and interest to be imparted to the photographic picture, beside judicious selection and tasteful arrangement, it will be by the process being so much accelerated, by optical and chemical improvements, that any moderate dimension and class of picture may be taken *instantaneously;* nor need we despair of witnessing this result, when we see what progress a few past years have brought with them to this art.

A desirable condition;

The benefit to be derived from an instantaneous, or *quasi*-instantaneous, picture, is equally great

generally applicable,

for every subject taken from nature by the camera, INSTANTANEOUS. with the exception of still-life, and mere geo- to all subjects metrical architectural elevations; here, as everything is fixed and stationary, the smallest possible apertures, and longest desired exposures, may be employed; and in this direction we may presume that nothing more is to be expected. But astonishing as the quality of definition may be that, under such conditions, is obtained; the result is where most required. often cold and mechanical, from want of *selection* in the point of view and deficiency in qualities of linear and aerial perspective, and *composition* of line and light and shade, therefore not possessing the interest that the smallest subject taken at the hedge-side, or on the sea-beach would have.

It is by the rendering of the vivid *expressions* Suggestions for pictures. of heads taken from the life, of the perspective view in the crowded city, with all its incident of passing and moving life, of sea and river subjects viewed in calm and storm; in the first, the white cumuli piled up, their snowy masses delineated to the depths of the cloud, the idle sails flapping on the masts, the bright reflexions from both on the Marine. water, full of drawing and *rippling* in the light breeze; the sombre rocks, or haven's entry, with the sharp surges dashing on them, the keen wind felt in every form of the moving waves; the fisher-boat's dark hull rising on the crested sea, dashing the white foam from her bows, the straining lines of her sails and gear yielding to the blast. In the landscape, the sky, one of the chief Landscape. components of its beauty, will not be a white blank, but by its lights and shades will give

INSTANTANEOUS. charm and value to the whole composition, and waving branches and moving leaves will cease to be curious mystifications.

Architecture. Views in distant and picturesque cities will not seem plague-stricken, by the deserted aspect of their streets and squares, but will appear alive with the busy throng of their motley populations.

All these subjects and many others will be glorious things to look upon, when they shall be rendered perfectly by Nature's own drawing. Disadvantages of long exposure. Shorten the time which the nervous sitter has to remain under the mesmeric influence of a gigantic glass eye, and you will see his contracted and rigid features expand, and a genial light diffuse itself over his face, and life and nature will be worthily represented.

Much of the foregoing is even now in our power to realize, but with our present limited resources we must be very modest in the *sizes* we attempt; size alone, in a photograph, when unaccompanied with high qualities of other kinds, only serves to make more visible the falling off from those excellences to which it should have attained. Small sizes with present means. Large sizes, from the *increased time* required for their production, are obviously impossible in this class of subjects, which will possess admirable qualities even if of the smallest dimensions. The great Turner's magical and lovely vignettes, which alone would have formed a colossal reputation, were not so large as the palm of the hand.

Favorable conditions. To take instantaneous pictures, we require first the most favorable conditions of light, subject,

atmosphere and temperature. We must next, by judicious selection, endeavour to secure equable BALANCE of *light and shade* and of *distance*; if the extremes are too great *in either* failure will probably result. For example, in the first, a chalk cliff in sunshine, with dark rocks in shadow at its base. In the second, objects as foreground taken *too near* the lens, and included in the picture with extreme distances; the result of which would probably be, that at large apertures—which the manipulation necessitates—the two extremes would not come out perfectly; if the development was continued until one part was satisfactory, it would be at the expense of the other. INSTANTANEOUS. Unfavorable conditions.

The class of subject the best adapted for this treatment is the marine—in it a more even balance of light and photographic action exists between the *sky* and the *water* which, with all its markings, will come out as rapidly as the sky itself, for the reason that in the reflexion of the subject to the lens the light is *regular* and undispersed; there is *all* the difference between the actinism of this class of subject and the *coloured* or *dispersed* light of terrestrial objects often containing a large proportion of the yellow or red pencils. River scenery offers more hindrance than other landscape, as the greens of the foliage, and the blue and grey reflexions of the sky on the surface of the water, have very unequal action; and a development which shall suit both is difficult: avoid taking such subjects looking *towards* the sun, as then the trees will be black masses without any drawing. Animals are very interesting Desirable subjects. Suggestions.

INSTANTANEOUS. objects for study by this process, and although very successful representations of them have been made, there is still much opportunity for developing the capabilities of the art in this direction.

The lens. The operator's first care must be the selection of his lens, which must be a fine instrument, or *all his trouble will be in vain;* that the chemicals to be employed are in the most perfect condition; the bath used should be thirty grain solution, not forty which, with the iron development, "fogs." It should be made of re-crystallized and *fused* nitrate of silver most carefully prepared; the writer has had *remarkable* samples from Messrs. Hopkin and Williams, which, *after long exposure to light* in the bottle, remain a light creamy white, free from all stain and darkening of colour. The bath must be *recently* and specially made and kept for this use only, and, though excellent afterwards for long exposures and general uses will, for this difficult and nice employment, only remain in its best working condition a short time. It will be well to have at hand two or three samples of collodion, more or less *recently* iodized; the developer, newly prepared, is to be used at the full strength of the three grain solution of pyro, if a cadmium collodion is used, but there is more advantage, in this class of picture, in using iron. Some of the best pictures, however, that have been shewn have been pyro-developed; namely, England's "Broadway," "New York," and "Rapids above Niagara," &c.

The chemicals.

Development;

For *absolutely* instantaneous pictures of *sky* and

water only, working *towards the sun*, the single, triplet, orthoscopic and double may be used; pictures have been published by Le Grey and others executed with the single lens, from 16 × 13 inches downwards. At the first size the reflexion of the actual sun's light on the distant waves is distinctly drawn, but the rest of the picture is obscure, and the effect is not day but moonlight. At the *above conditions* a first-rate three and half diameter of portrait lens, ten inches focus, gives a good printing negative with the effect of *daylight;* as do the triplet and orthoscopic, not however so vigorous in action as the first. The waves near at hand, size one and a half inch in the picture—not distant—and boats *crossing the field close to the camera* with considerable velocity, in a stiff breeze, are *absolutely* fixed and without motion (is in the writer's folio)—sea and Hastings boats off Dover. Water and sky working *away from the sun*, boats, shipping, &c., in movement, three and a half aperture, six inch focal length is the largest that can be successfully undertaken with first-rate conditions of all sorts, lens, light, chemicals, and with the objects not taken *too near the immediate foreground*, or *crossing* the field close at hand; *absolutely* instantaneous pictures can be obtained of 5 × 4, with considerable certainty; good printing negatives with effect of *daylight*. The same size can be executed with the triplet No. 1, but the deposit is weaker on the glass and the proofs are sombre in effect. The advantage of the triplet is its greater "penetration." The *clouds* appear in the picture working *away from* the sun.

INSTANTANEOUS.

greatest facilities;

increased difficulties.

Data for operating.

INSTANTANEOUS.
Stereoscopic

At the stereoscopic size with Dallmeyer's or Ross's one and a half inch portrait lens, conditions of light and temperature 70 to 75 Fahr., in the months of May, June and July pictures may be taken with encouraging certainty. In cities select a high point of view—from the first floor—it has the following advantages: The whole picture consists of objects more evenly balanced as to focus, and being at a certain distance from the lens larger, even the largest, aperture can be used without damaging the drawing of the subject. Secondly, the living and moving objects being further removed their motion is considerably reduced, and another difficulty is modified; whilst the elevated point of sight permits a long perspective of moving figures, animals, &c., to be delineated, which had the picture been taken from a lower point of view, would have been entirely masked and hidden by the exaggerated size of those in the *immediate* foreground; which latter, lost from quick motion, would probably be mere smears, and thus the whole result abortive.

subjects in cities; their peculiarities;

It is not, however, *impossible* to do such subjects from the street level. The writer can show results on plates eight by six, in which examples—without any communication with any person in foreground—groups, every object, including dogs, horses, and human subjects, are as firm as the lines of the buildings; the latter have all their half tones even to the lightest on *white* surfaces *more* delicately discriminated than in the longest exposures; the quality of the negative creamy, perfectly covered, and that without the least forcing

data for.

of the development. Season—June, splendid weather. A quay at Ramsgate *open entirely to the south*, temp. 68°, 1 o'clock p.m., lens, Ross's, three and a quarter, ten inches focus; two inches diaphragm. Exposure quasi-instantaneous. Bath new, forty grains sol. *recrystallised* and *fused* nitrate of silver, absolutely neutral. Cadmium collodion developed with three grains pyro. The picture "dashed out" on applying the developer.

INSTANTANEOUS.

Taken from low level.

Mr. Wilson, Mr. England, Col. Stuart Wortley, Mr. Breeze, &c., have shown excellent results of instantaneous exposures. The writer has taken *instantaneous* pictures of all descriptions, horses in motion in the parks, boats and sea, &c. The most difficult subject treated was the following: Ludgate Hill and St. Paul's from a first floor in Fleet Street—May, light indifferent, contaminated by London smoke; size of picture attempted large for the subject and light—nine by six inches. Lens double, four and a half Ross, fifteen inches back focus, three inches aperture; repeated failures for two hours.

Difficult subject.

Ultimately a good negative obtained with extraordinary definition, the bricks and tiles of the houses, names of streets, and on moving omnibuses, the moving throng of passengers and vehicles well depicted. Iron developed, considerably intensified, *fixed* and re-intensified. Result—a printing *negative*, but of a sombre, not light and brilliant, character.

Data respecting.

To uncover the lens the contrivance shown in the woodcut is recommended, having the advantages that it leaves the operator at full liberty to watch

INSTANTANEOUS.

his subject, and by pulling a string at the moment he judges opportune taking the picture.*

Instantaneous slide.

The *falling* slide can be screwed on at *a a* to the front of any camera, B; the lens operates through the aperture A; the slide, *when drawn up*, covers it with the bottom portion C; now, on relieving a catch it falls by its own gravity —the most *even* and instantaneous motion possible—and the opening in the centre allows the lens to see the subject for a distance varying from half its diameter to two diameters, according as the

Fig. 63.

Description of its action.

two shutters D D may have been adjusted with their respective screws *b b*, this alteration in the aperture regulating the degree of exposure of the subject.

Another method.

The same result can be arrived at by the rotation of a disk of thin metal or of wood, centered in a similar manner to the diaphragm plate of microscopes, with a strong spring of vulcanised India rubber attached; on releasing a catch the rotation of the perforated disk will cause an aperture of

Before or behind the lens.

greater or less size to pass the lens. This arrangement may be made either in *front*, or within the camera *behind* the combinations.

* This shutter has been most neatly and efficiently made for the writer by Murray and Heath.

The mode of exposing by the cat's-eye principle is faulty, inasmuch as it gives a longer exposure to the *centre* of the lens, thus increasing still more the unequal action already existing between its definition and that of the margin. INSTANTANEOUS. Faulty arrangement.

As has been previously mentioned we must anticipate great advances in all directions in Photography, and no doubt the sensitiveness of the chemicals will be much increased; but even with the means *now* at our disposal, *printing negatives* of moderate dimensions can be taken in the fraction of a second, perfectly representing the various objects seen in nature, whether in *motion* or not. It suffices that the student should give considerable attention to the instructions previously given, to secure a satisfactory result. Anticipated advances; possible with present means.

LANDSCAPES.—The photographic landscape, judged by the rules of art, is yet far from being a *perfect* work. It presents to the spectator many charming parts, but taken *as a whole* it is defective as a picture. The sky, that principal point of the landscape painter's selection and care, in the photograph has no existence, but remains a blank. If a river or water in any of its many picturesque combinations of river, lake, falls, &c., enter into the subject, the treatment of it by *lengthened* exposure in the camera becomes a photographic conventionality, with certain smudgy reflexions in the one case, and woolly-looking white patches in the other; wanting entirely in the *drawing* of the ripple of the near water, the beaming light or passing shadow of mid-distance, or the sharp sparkling dash of the mountain Beautiful in *details*. Sky and water wanting.

LANDSCAPES stream. The trees in most instances have waved their branches backwards and forwards during the execution of the picture, and on what should be their delicate and feathered margins, enigmatical forms are found.

Other drawbacks.

These points render photographic landscape seldom quite perfect as a whole, though exquisite in the detail of its parts; and when by dint of careful selection and study, anything approaching a satisfactory result is attained, it should be valued in proportion to the difficulties overcome.

Successful results.

Generally speaking, the subjects which will offer the best conditions to the camera, are those situate amid *mountainous scenery*, as Tyrol, Norway, Switzerland, Wales, and the Highlands of Scotland, for the reason, that the height of the distances dissimulates the want of sky, and, indeed, as they are full of sufficing forms and drawing, are better left in repose. The masses of rock in the foreground and middle distances are rendered by the camera in a manner which leaves nothing to desire, and the whole being composed of rigid forms, any degree of desired definition may be attempted with probability of perfect success. Mr. F. Frith's recent Swiss views completely illustrate the foregoing observations.

Best applications.

Injudicious subjects.

The subjects which are least adapted for the camera, are views on plains, over sands, and generally all subjects of *low horizon*, in which the *sky* or water form a large portion of the picture. When trees are introduced, calm days must be selected, as then there is little or no movement in their branches; or situations chosen—such as

glades in woods—where shelter is afforded by the contiguity of masses of foliage. Picturesque "bits" of landscape, with water and other mills,* ruins, cottages, &c., selected with care will come well, these objects giving point and incident to the subject; a large field is yet fallow of STUDIES of useful details of foreground, for the treatment of which the camera is eminently qualified, and such subjects will be very useful to art.

LANDSCAPES
Portions as *studies*,

If in photography the entire landscape is to be attempted as a complete work, which shall satisfy the critic, it is to the instantaneous process we must look, if even the result, as regards *size* is limited, as by that treatment alone the combination of *sky* with hill and dale, and river or lake, will be obtained, and all the captivating effects of passing cloud shadows, and gleams of sunshine on different portions of the landscape represented. These are effects of light that have seldom been photographically rendered, and the difficulties are of course greater from the greens of foliage offering impediments to rapid exposures, but which, however, *at small sizes*, are not insurmountable if skilfully treated.

entire landscape.

Sky, water, and cloud shadows represented.

If a necessity from circumstances arises to represent photographically a landscape subject where, from its low horizon, the sky in art would play a leading part, especially in any sizes above the smallest—printing from two negatives appears to the writer the only method of rendering a

Low horizons.

* No better illustration could be given than Mr. Bedford's picture of "Holy Street Mill," recently printed in carbon by Swan's process.

LANDSCAPES satisfactory and artistic representation of nature.
Double printing, Nor, apart from the expense in printing and rather delicate manipulation required, can such practice be condemned by any canon of taste, but rather the direct contrary. Landscapes are generally the result of considerable exposures for the reason that unless the lens is used at small aperture the distance fails to be included in the picture, and next that the greens of the foliage being as a colour intractable are apt if not well worked into to come out black and bare on the glass. The above conditions infer solarisation of the sky; to a greater or less extent to "stop it out" therefore altogether is desirable.

Modus operandi. The landscape negative having been finished it would be well that the one of the sky should be at once proceeded with; provided always that the appearances were favorable, as it would certainly not do to copy any poor-looking clouds that happened to be overhead. Still, if at all picturesque, the sky taken immediately subsequently to the lower picture will have this great advantage, namely, that from the same point of view, and at quasi the same moment of time, the effect of light or shade will be homogeneous upon it, and the subject to which indeed "if right were right" it properly belongs. To take this sky proceed thus: The best lens to employ for the purpose is a triplet—

Best lens for skies. well stopped down, *i. e.*, to half or one third of its diameter, which has a greater penetrating power of delineation for this purpose than any other lens; the collodion a high coloured sample, and for any other use an insensitive one, but which for

this purpose tends to avoid weakness and fogging, and gives sufficient details in drawing; the exposure nearly or quite instantaneous according to circumstances; if the sky is composed of blue sky and white scirri or cumuli, it will not photographically give a satisfactory result; the best one to be anticipated is from a sky well covered with rolling grey clouds, some of very great and threatening depth of colour well varied and modelled in their forms, side lighted with vivacity and piquante effects, and little, or, better still, *no* blue patches showing. It is indeed a very great chance if such conditions, which generally imply wind, rain and anti-photographic light, will find the landscape photographer at work at the subject; so, failing that, he must proceed in the most artistic and homogeneous manner as regards the quarter whence *both* were lighted, to adapt a previously or subsequently taken sky to his landscape, which will have one advantage—that he will by selection be able to adapt one which shall compose properly with the leading lines of the composition of his landscape, and not place one which is a mere repetition of the forms seen beneath it.

LANDSCAPES

Difficult skies, more favorable.

He must not *follow* the lines of his subject or *double* them, as it were, by the adapted cloud forms, but antagonise and vary the lines of the composition. This may be illustrated thus: The great masters of landscape painting of the Dutch school, from the nature of the country which gave them the subject for their pictures, generally have a flat low horizon occurring in them; under these

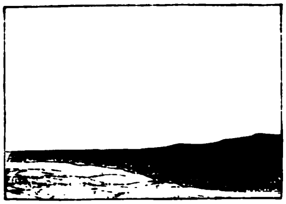
Mode of adapting.

LANDSCAPES

Practice of great painters,

conditions, William Vandervelde or Backhüysen in their sea-pieces, Jacob Ruysdael, Wynants, &c., in landscape, always make the forms of their skies play a very leading and important part as thus—this outline (64), which is that of the coast at Schüveningen, is in itself sufficiently monotonous, and would remain so

Fig. 64.

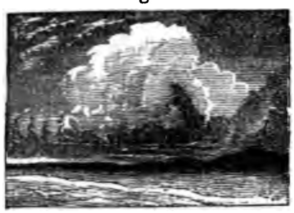


were cloud forms of the same character (65) added

exemplified.

Fig. 65.

Fig. 66.

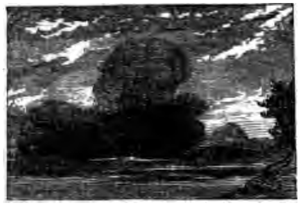


to it; Vandervelde (66), however, treats it more skilfully and with this result. Now the same form of sky unskilfully adapted to a subject of woodland scenery (67) would be entirely misplaced, the more so in proportion to the *want of judgment*

Different adaptations.

Fig. 67.

Fig. 68.



shown in adapting it. Here *contrasting* forms (68) of quite a different character to the rolling masses of foliage are required. To pursue the subject farther would lead beyond the scope and limits of this volume, and into the domain of art-composition; these few suggestions are merely thrown out to point out to the student the desirable direction —intelligent reference to the works of great painters, either from the originals or prints, must do the rest. In treating landscape subjects with the camera the dimensions proposed must be studied, and in accordance with those the treatment is governed very considerably by the class of lens employed, which must be adapted to it. Thus, in small pictures six by four to nine by seven inches, the greatest finish and delicacy of definition will be requisite. No. 1 triplet gives this beyond any other lens; in larger works, eighteen by fourteen, such minute delineation would be erroneous and misplaced. Here a single or orthoscopic lens of an appropriate size to cover the surface with bolder treatment is the description to employ.

LANDSCAPES

Suggestive remarks.

Different sizes;

To illustrate the foregoing by the true standards of excellence in artistic representations—it would be as palpably absurd for an historical painter to give the minute finish of a Terburg or Metzu on a canvas of vast dimensions, as it would be for Meisonnier to aim at coarse execution on his tiny panels. In engraving, the delicate lines of a small subject in an Annual give place to bold, vigorous, trenchant scorings in the treatment by Doo of John Knox preaching. From a want of knowledge of the principles of art in many photographers a

their varied treatment.

LANDSCAPES morbid admiration and reverence of unnaturally *minute definition* tends to lead the operator away from what should really be the end and aim of his study. Instead of "going in" for the broad vigorous effects of *light and shade* in the landscape he is led to look upon a mechanical "organ grinding" kind of exposure consequent upon absurdly reduced aperture as the correct thing, whilst to the eye of the artist the much vaunted result appears like a landscape carefully black-leaded, and then executed in minute needlework, qualities which are no compensation for the want of the broad and vigorous effects of light and shade which have been given* by the lens when skilfully applied to this class of subject.

Unnatural definition; its results.

The student should note distinctly, that however astonishing and captivating good definition and detail may be in *studies of foreground*, &c.; in the *general* landscape, fine broad effects of light and shade will supersede it all. Mere clean mechanism on the plate grows monotonous, and will always succumb to the sentiment conveyed to the mind of the spectator by representations—photographically less perfect—in which any of the changing effects of light and shade may have been successfully rendered. The artist should likewise consider that *careful and discriminating selection* will make itself felt in this, as in every other description of subject, and must not go out with his camera as to a sort of photographic battue, in which *one well studied picture* seems not to be

Effect more than detail.

Tasteful selection necessary,

* Fenton's Valley of the Wharfe, *inter alia.*

the desideratum, but *quantity* not *quality* is sought for. Now, the truth is, that one little bit of well selected fore-ground, a bank with a few docks and thistles, with the bright sun-ray glancing from the tufted grass to the grey ivy-grown stump of the gnarled pollard, is worth a hecatomb of such things.

LANDSCAPES application.

The execution of landscape pictures entails the necessity of having a tent, van, or some other means for the manipulation of them, since *very few* operators have been so sufficiently successful with any of the dry processes that the results of their manipulation can be regarded with the requisite certainty of a satisfactory issue, or have rendered the recalcitrant greens of the landscape with anything at all approaching the power and sensitiveness of the ordinary wet collodion. Whilst at the same time the photographer may, in these railway times, be several hundred miles distant from *the* pet subject of which he fondly imagines he has a transcript, safely in his baggage, but of which illusion subsequent development proves the fallacy; the only certain way is to *see the result* before leaving the spot. Several very ingenious contrivances, combining lightness and compactness, have been perfected of late years, which enable the landscape photographer to meet the above requirements; amongst those that have been put to the test of practical use may be noticed those of Messrs. How, Thomas and Rouch. The first has been subjected to the severe test of extensive practice in the climate of India; the next was very advantageously used in Spain by the late

Boxes or tents necessary.

Disadvantages of *dry* processes.

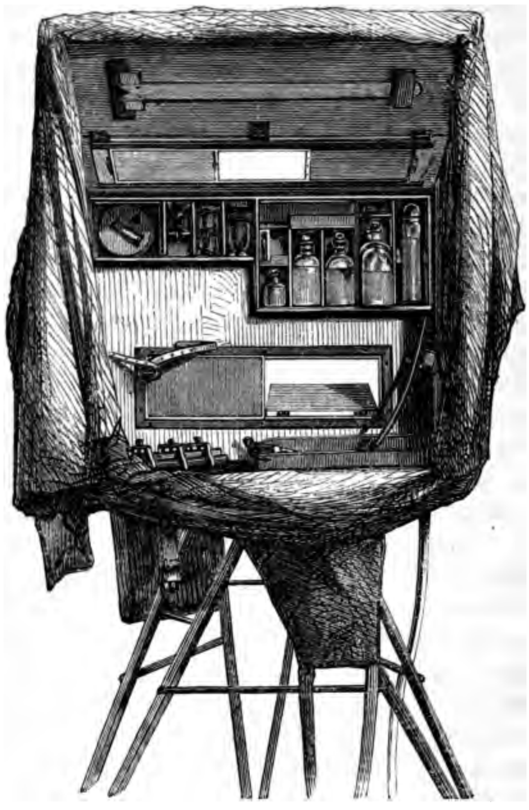
Various contrivances.

LANDSCAPES

Travelling box shown.

Mr. Thurston Thompson, in his photographic tour in that country; whilst Mr. Rouch's has a large and deserved popularity from its suitability to the

Fig. 69.



Objections to tents.

use proposed. The objection to the tent is its want of rigidity, and itself being or requiring a separate package. The woodcut shows the construction

of a *box* which *contains the whole* of the photographer's material of camera, lenses, baths, &c., and at the same time opens into a *rigid* and sufficing operating space with shelves, sink, and every necessary appliance, and has been in practice found to answer most admirably up to sizes of twelve by ten; which, with the minute qualities of photographic representation, is really large enough for most subjects. LANDSCAPES. Box described.

The woodcut represents the box; but with improvements upon its construction, as it first appeared in the former edition; these are due to Messrs. Murray and Heath, by whom it was originally, and is now, manufactured.

The lenses proper to employ for landscape pictures are both single and double; the first to be used when the subject is of that nature that some size is required, and that it will not suffer by a lengthened exposure; the best diameters are two and a half, three and a half, and five inches, covering respectively eight inches by six, twelve inches by ten, and sixteen inches by twelve; the aperture to be used will be better *reasonably* small if the subject is well illuminated, since under that condition the extreme planes of distance will be more perfectly rendered. The triplet, especially when refinement of treatment is desirable; Ross's wide-angle doublet, and Dallmeyer's wide-angle rectilinear, in *many situations* where it is necessary to take the subject at close quarters; and the double portrait combination where, at small sizes, a favorable opportunity is seen for quasi-instantaneous treatment of passing effects of chiar-oscuro. Appropriate lenses. Sizes of pictures. Data for lenses.

LANDSCAPES Working towards the sun. Many very charming effects of aerial perspective, marking the different planes of distance, in undulating or mountainous country, are obtained by working *towards the sun*—this must be done when it is not *too near* the horizon, as then the light would look directly *into* the lens. Such treatment of the subject requires precaution to avoid fogging; it is well to shield the lens, whether Precautions. single or double, by a dark cloth, which can be held above it.

If the student has no previous knowledge of *artistic* treatment of landscape, he should make himself familiar with the works of Claude, Turner, Vandervelde, Ruysdael, Wynants, Both, and our own great living talents in this department; as has been previously said, mere skilful mechanism will Cultivation of taste most necessary. not suffice; if Photography is to take stand as *an art* those who practice it must qualify by study for artistic requirements. A short time will suffice for an intelligent mind to imbue itself with as much knowledge of the subject as will prevent egregious blunders; careful practice from nature will do the rest.

Facilities of execution. ARCHITECTURE.—Of all the subjects offered to the camera, none are more facile of execution than those from architectural originals; their rigid and immoveable forms, the large area of the surfaces reflecting light to the lens, in open air and sunshine, present advantageous conditions, which enable *larger* sizes to be covered, smaller apertures to be employed and longer exposures to be given, than any other class of objects.

Result. It may, indeed, be said, with considerable con-

fidence, that in the close imitation of the originals, by Baldus, Bisson, and the Roman photographers, a limit has in this direction been attained which it will be difficult if not impossible to surpass. ARCHITECTURE.

At the same time that we feel that the mechanical excellence shown in these subjects has been such as to delight by its clear definition and precision, regret has been experienced by artists and amateurs at the mere "geometrical elevation" effect which has characterised some of the best subjects hitherto executed, and which has rendered them much more fitted as *documents* for the office of the architect, than complete and agreeable as *pictures* to the lover of art. Mechanical excellence wanting in artistic qualities.

In looking at a series of architectural photographs of the foregoing description, it is impossible not to wish for the completion of the *subject* by the selection of a more picturesque point of sight, the infusion of more artistic qualities into its composition, and its completion, as a whole, by the representation of that foreground and accessories which in nature made it captivating by contrast, and formed a base from which the edifices represented rose.

The *mere size* of some of the large subjects of architecture, does not compensate to the artist for the loss of those incidents of perspective and composition, and qualities of light and shade, he would have preferred seeing in the picture, and which at *less dimension* were quite within the scope and province of the lens. *Size* alone not sufficient.

If very large sizes are undertaken, they are of

ARCHITECTURE. necessity from *plane* or nearly plane surfaces, the wondrous manner in which the lens draws every minute break, angle, or varying surface in the perspective view is not seen; and though our first impression is surprise at the *dimension* attained, our subsequent feeling is indifference to the subject, which, by its mechanical treatment, ceases to interest as soon as its mere novelty has subsided.

Lose their interest.

Medium and even small sizes, therefore, are desirable, which shall enable the photographer to produce *pictures* having the composition of line, and qualities of light and shade we are accustomed to admire in the works of the painters who have treated this class of subject, Canaletti, Panini, &c. The photograph possessing in addition, the interest given by its being the actual reflex of most interesting localities, and the gratification imparted by the delicacy and minuteness of its execution.

Qualities desirable.

Applications to subjects.

The mediæval remains of our own country, historically so interesting to us; the florid Gothic edifices of Spain, her mauresque architecture, the intricacy of whose details bewilders the eye of the draughtsman; the cinque-cento arabesques of Italy, sculptured in marble with an artistic grace and finesse which defy the pencil; all can, with the utmost facility, be rendered by the camera. We have, indeed, had evidence of what photography is capable of producing in the Egyptian pictures, which have been executed by means of the camera; the hieroglyphic-covered surfaces of those colossal ruins never could have been rendered by any other means: we must hope that *well directed* study

on the part both of professors and amateurs, will give us further interesting and useful subjects. ARCHITECTURE.

However, in whatever manner they may be treated, it is certain that the facilities for near comparison and study given by photographic transcripts from remarkable architectural examples, will produce as striking results, by the advancement of taste and knowledge, in this, as in any of the applications of the art. Facilities for study.

In the earlier practice of photography, the *single* lens alone was employed to execute this class of subject; subsequently, some of the most perfect representations of edifices have been made by using the *double* lens, at very small apertures; there is much more rotundity and realisation of the forms of the subject in the latter mode of treatment. The size of lenses employed, if double combinations, is considerable when *large* pictures are desired; six and eight inch diameters were used by French photographers for some of the elevations of portions of the Louvre. The single lens giving a much larger picture, at the same diameters, has the advantage of greater portability for the amateur, who would find an eight-inch double lens a cumbrous companion. Single lens. Double lenses. Data for sizes.

More recently new lenses have been introduced, and the writer has used them on subjects of this nature. For large sizes he found that the Petzval orthoscopic offered great advantages; its portability compared with the double portrait combination was very great, whilst it worked better up to the margins of the subject. It far exceeded in delicacy of definition, and discrimination of textures, Recent instruments;

ARCHITECTURE.

qualities described.

and working into deep shadows, the single or landscape lens, and was even more portable than that; whilst at the size of twelve inches by ten, the pictures produced may be considered, in delicacy of finish, quite equal to those executed by the triplet. The writer used this form of lens, made by both Ross and Voigtländer, in several sizes. The largest dimensions he produced were 18 × 14 inch plates. The following are the most useful memoranda: The Forum, Rome; foreground, the temple of Saturn within fifty yards of the lens, distance Colosseum half a mile, both included in the picture; size 18 × 14; lens No. 3, Ross orthos.; $\frac{5}{8}$ diaphragm; Thomas's collodion, iodized three weeks; bath, thirty grains recrystallised nitrate, just acid; three minutes' exposure; development, pyrogallic $1\frac{1}{2}$ grain, *when well out*, the picture being large, strengthened with twenty minims nit. sol. thirty grains strength—Result, fine creamy negative. For such a picture as the above, the pyrogallic developer is decidedly better than iron; since the size requires bright, vigorous treatment, and iron, *at these sizes*, is apt to give an over-detailed weak-looking picture. Size 12 × 10, if *near*, treat with No. 1 or 2, according to quantity of subject intended to be included, and vicinity of objects to camera. If *distant* No. 3 or 4; all were done by the writer with such modifications of the above treatment as might be necessitated by light, &c.; being in the main very similar. Note, especially, that in using the above lens, it is *most necessary* to shade its surface very completely, so as to avoid fogging. Dallmeyer's

Precise data for various dimensions.

triplet has been also used for about the foregoing size, on Roman subjects, by Soullier, developed by iron; the results shew great finesse of detail. In confined situations, it will often be necessary to have recourse to wide-angle lenses, in order to obtain, photographically, the subject. ARCHITECTURE.

When the operator desires to produce a detailed representation of a flank of an edifice, as a geometrical elevation, the mode of proceeding is as follows. If windows in buildings immediately opposite permit, endeavour that the lens shall be placed at about one half the height of the subject, instead of on the ground, whereby the proportions will be better observed in the picture. Carefully *level* the camera with the spirit-level, to preserve the lines in the perpendicular, and use the *smallest diaphragm* the nature of the light will allow. These pictures will be perfectly calculated for the use of architects, as if skilfully taken they may be considered as *exactly drawn to scale.* Geometrical elevations. Mode of treatment.

If it is desired to produce works of a more artistic character, in which various masses of buildings, at different planes of distance, are introduced, *less dimensions* must be attempted; in some such subjects, as for instance, views of Florence looking down the Arno, of Paris from the Seine, &c.; the want of figures in the picture is not so much felt as when the squares and streets of populous cities are represented; here, if anything approaching the appearance of the originals is to be shown, it can only be by combining in the picture the moving panorama, and Picturesque combinations. Complete pictures.

ARCHITECTURE. not giving a Pompeian aspect to the most crowded and busy thoroughfares. For the first, single or stopped down double lenses may be employed indifferently; the resulting pictures will be distinguished by the less size, and greater definition in those taken with double lenses; for the second double lenses can alone be used. The operator must avoid *large masses* of shadow, and if skill is shown, pictures of ten by eight inches may be thus obtained, not but that very considerable difficulties must be contended with and overcome; but if *a picture* of this class of subjects is to be presented to the spectator which shall impress him with the aspect of the original, as seen in nature, it is to this treatment alone we must look for success.

difficult of treatment,

but possible.

Different classes

MARINE SUBJECTS may be separated into two classes, *afloat* and *ashore*; it is needless to observe that the only treatment to be adopted with the first is the *instantaneous;* and these subjects, even with the means the optician and chemist have already placed at our disposal, are quite possible, and only want proper artistic *selection*, and sufficient photographic *skill* to reward the operator by most interesting pictures, infinitely less difficult than subjects on land, from the water and sky giving a much more powerful reflex of light to the lens. The writer has had considerable experience in the treatment of this class of subject, and although patience, under failures, is required—as it is in all instantaneous processes—the before-named conditions permit sufficiently encouraging success. The most facile treatments

instantaneous,

are those *working towards the sun*; with care and clean manipulation, the pictures, at the *smallest* sizes, with the lenses now made, really offer no noteworthy difficulty. The requirements are a neutral bath of *fused* recrystallized nitrate of silver, thirty grains sol.; a good sample of collodion, of any of the best makers; A FIRST RATE LENS, well shielded from diffused light; and a falling shutter so contrived as to fulfil its purpose, vide page 182. A very good double shutter in wood, quite capable of giving an *instantaneous* picture by its quick action is made by Messrs. Rouch and Co., of the Strand. With skill, the focusing velvet may be made to do duty, but smudging movements frequently occur in pictures thus taken. Le Gray produced large pictures of sky and sea, 16 × 13, *working towards the sun*, with a *single* lens, but they were considered to be "moonlight" representations by the general public. The largest sizes the writer would recommend to be attempted, are given by the 3½ double lens, ten-inch focus, and these are difficult, same diameter six-inch focus less so, and Dallmeyer's, or Ross, special small *instantaneous* lenses, stereo size, least of all.

MARINE SUBJECTS.

Success probable.

Data for dimensions.

Marine subjects *on shore* may be treated by longer exposures, and with either single, double, or triple lenses; they comprise fishing cobles and other small craft; capstans, buoys, anchors, and all sorts of picturesque fishing and sailing gear, lying on the rocky or sandy beach; and, combined with them, it is quite within the scope and province of such a photographic subject that groups

By longer exposures;

their nature.

ANIMALS. of analogous figures, which are always at hand, should be introduced; observing only the caution given in another place, and make the picture if Suggestions. possible, tell a story, or at least let its figures have their occupation and attentions *within it*, and not directed to the camera. Here, indeed, at our own doors, a most attractive field for displaying ingenuity in arrangement, and artistic feeling in execution, offers itself to the student.

ANIMALS.—A class of subjects which has been little treated by photographers, and which yields to none in interest, are animals from the life. They of course present insurmountable difficulties Rapid execution necessary. for any mode of treatment which implies a lengthened time of exposure, but most exquisite things, of a limited size it is true, are quite within the power of the operator; and by taking them in full sunlight, with rather large apertures of a double lens, pictures may be obtained which Artistic interest. possess high qualities of artistic interest.

Horses have been taken by the writer on 12 × 10 plates, with $4\frac{1}{4}$ and 6 inch lenses of 15 and 20 inches focus; and he is not aware that larger sizes have been accomplished. Groups are interesting, but of course the difficulty which is very great with one animal increases *pro rata* as each additional "sitter" is introduced into the picture; a whisk of the tail and it has disappeared from the negative, a slight pricking up of the ears and Photographic tribulations they have vanished; the quick action and heavy deposit on the sky has, in a fraction of a second, totally obliterated them. The writer has taken all sorts of sizes and kinds of animals, the instru-

ments used varying from the 6 inch double combinations down to the small $1\frac{3}{4}$, with which latter "flying shots" succeed perfectly at animals *in motion;* the resulting picture is small it is true, but highly interesting: instead of stiff posed figures, the easy seat in the saddle, the conversational air of the groups, the ladies' habits blowing in the wind, and the air of movement as the advancing horses have their legs raised from the ground in the act of trotting or galloping, is very delightful. At the largest size the curvature of the line of true focus in the lens makes itself disagreeably felt in the enlargement of the lower half of the legs, and if the animal should turn his head towards the camera the lower portion of the head becomes enlarged, thus at once detracting from the look of breeding that existed in the original. Excellent results, however, are attainable at about 3 or 4 inches to the outside each way of a horse and rider, provided there is patience under difficulties, *on both sides of the camera,* fine light, and that the operator has a first-rate lens and chemicals in *perfect order*. The larger Feræ are easier than the horse—the attention of the lion and tiger may be fixed for two or three seconds—but then there is the disadvantage that they appear on the gridiron in the resulting picture as they have glared at the operation through the bars of their dens. The elephant, rhinoceros, and all the deer tribe, have been photographed with considerable success. Count Montizon, some years since, took pictures in the Zoological Gardens which have never been exceeded in quality; they

ANIMALS.

Absolutely instantaneous.

Largest dimensions.

Animals in menageries.

ANIMALS. Data respecting

are about 5 × 4 inches, and are evidently the work of Voigtländer's $3\frac{1}{8}$ inch diameter, 6 inches focus, double lens. Mr. Haes has more recently taken up the same subject with much enthusiasm and very successful result. The writer has in his folios many studies made by himself in the same locality. Dogs are difficult, and their caudal appendages have an unpleasant propensity—photographically—to drop off. It becomes a desperate moment when, casting his eyes on his master,

Canines.

"the sitter" commences that pendulum-like motion. Once again the reader is cautioned not to attempt too ambitious sizes with large lenses; the smaller dimensions will have better qualities of perfection of focus, and consequently better drawing of the "points" of the animal, and the operator will spare himself a world of disappointment and vexation.

It is well, in treating them, that an arrangement should be made, whereby the operator and his apparatus are entirely hidden from the animals, as otherwise, his advance to the camera, the act of uncovering the lens, his every movement, will cause the ears, eyes, and heads, at the least, to be defective in the picture.

Desirable precautions

This is very easily managed, by a canvas screen of small size, supported at each end on sticks, with pegs and strings to give it firmness, and an aperture in the centre only large enough for the lens to pass through. It will, in most cases, be much better if a contrivance for uncovering the film to the action of light is made *inside* the camera, behind the lens, as thus all movements

that would disturb the animals are entirely avoided. If the lens has a projecting shade over it, the chance of fogged pictures from the action of reflexion on its large uncovered surface will be diminished: whilst at the same time—as it is more concealed—horses and shy animals taken at near distances, are less alarmed by its brightness. It is likewise an excellent expedient to place small branches of foliage, trusses of hay, or any familiar objects which may happen to be at hand, against the canvas. A black curtain—excellent for many other purposes—may do duty on this occasion for the screen; the dark colour, so far from being objectionable, is better than a lighter for several reasons.

ANIMALS. against fogging

and movements of the animals

The same result may be arrived at by taking them actually from the photographic carriage, which in some cases, as deer, &c., will be found convenient, as they may be followed. Remark only, that just before taking the picture it will be necessary, by the insertion of wedges of wood, or other contrivance, to neutralize the action of the springs of the carriage, or the image will suffer; also that the aperture for taking the picture should, by its distance from the ground, correspond to the average height of the human eye, otherwise the picture will appear unnatural; as if it is taken from too high a point of view, the animals will seem to be *looked down* upon. The arrangements for bath, collodion, developer, &c., must be precisely similar as for instantaneous pictures.

taken from a carriage.

Precautions.

PATHOLOGY AND CHIRURGERY.—Photography is now very generally utilised by the medical pro-

PATHOLOGY. fession to depict the various phases of disease and

Valuable application; chronicle, in perfection, the antecedents of formidable operations and the subsequent appearances presented, up to perfect convalescence. For this most valuable application of its powers "quick acting" short focus double lenses are the instruments which are required, as the light, in the wards, &c.. of hospitals—from which the sufferers cannot be removed—is photographically exacting. Very excellent and satisfactory results are, however, by the employment of these instruments arrived at. Mr. Charles Heisch, the able demonstrator of chemistry at Middlesex Hospital, has been amongst the most successful in

results. applying the resources of photography to this eminently useful and practical result.

Numerous interesting and instructive cases have been thus "registered" by that gentleman to the great benefit and advancement of medical science. The writer has been favoured with the inspection of a large folio of prints. The most successful of these were taken with a Voigtländer double lens No. B, two and a half inch diameter, six inches focal length, which possesses the characteristics—most valuable for this purpose—of rapidity of action combined with considerable flatness of field; which enables it to cover a larger surface, satisfactorily, than its focal length would intimate; five

Data for instruments. by four plates, *well* covered to the edges with all details perfectly given, at its *full aperture* the head of the half length figures nearly an inch. It is capable of taking a head of nearly two inches, with the bust only, in *perfect* drawing, by the insertion

of a one and a half inch aperture diaphragm, and is decidedly an excellent lens for these subjects. The writer used for somewhat similar purposes at the College of Surgeons a $3\frac{1}{2}$ diameter, six inch focus, double Voigtländer; which is an excellent lens, but of nearly double the cost of the former. Dissections can be placed in more favorable light—not in direct sunshine, as the too violent light and shade interferes with the requisite nicety of delineation of minute forms—but in *external* vigorous diffused light; they can be taken of large and useful sizes by the single, double, and triplet lens. The same treatment applies to studies of the osseous structure, in which the power of delineation by photography is most remarkable; carious bone, and diseased crania, &c., could by no other possible means be so completely depicted.

PATHOLOGY.

Dissections and preparations, the bones.

An apt illustration of one of the practical pathological utilisations of photography is the following: A young lady, suffering from severe deformity, was seen by an eminent London practitioner, who found that whilst under curative treatment sea air was an imperative necessity—she was ordered to Devonshire. Now, in the old time, either at enormous cost the doctor must have gone above 200 miles to his patient, or she been brought up the above distance, at considerable risk to her health, or, otherwise, have been left to take her chance. A photograph of the state of the case was forwarded to London for weekly comparison with those previously taken, which, conjoined with the report of the local "general practitioner," enabled the authority at

Practical utilization.

STATUES, &c. head quarters so to direct matters that a thorough cure was effected.

Doubtless, in the future, many other such desirable developments of the useful applications of this art will be discovered.

STATUES, BUSTS, BASSI-RELIEVI, AND BRONZES. The above objects are amongst those which offer few difficulties to the Photographer—neat and careful manipulation will enable him to produce with much certainty good pictures, for the diminution of aperture and duration of exposure is of no consequence; whilst, at the same time, if the manner in which they are lighted and reflected be well arranged and the background judicious, delineated by means of Photography they will have a beauty of drawing and rotundity which can be attained in no other manner.

Facilities offered.

Perfection of representation

To the tyro in the art, desirous of applying himself to portraiture, some preliminary practice from busts is most desirable; as by such study he will gain the power of comparing, with the *greatest exactitude,* what the effect of certain apertures of his lens, distance from the object, and time of exposure, under different conditions of light, have in rendering the result more or less perfect.

desirable for study.

Proper treatment.

The best treatment to adopt for works in marble is, that they should be executed with a *triplet lens,* in moderate light; thus more rotundity is obtained, and the transitions are not too violent, as they would be liable to become—especially if modern works, in pure white marble, were treated in too violent light. Startling effects

of sunshine are not for this class of representation; they detract from the delicate modelling of the *forms* of the originals, which should be the principal object to attain, and in pictures so treated a coarse, harsh effect in the appearance of the statues or busts is observable. STATUES, &c.

The great works of antiquity offer, unfortunately, two great obstacles to their being rendered photographically, which, could it be perfectly accomplished, would be most interesting to the world of art. They are for the most part in situations in which the want of light prevents a successful result, and from which their great value and weight prevents their being temporarily removed. Added to which, the fractures and yellow earthy stains existing on most of them, make themselves disagreeably conspicuous; and though there is a remedy for this in the *very lightest* possible wash of whiting or plaster and water, skilfully applied, it is more than doubtful if, in the majority of cases, its application could be permitted. Antiques, obstacles to their delineation; stains on them; remedy.

Such originals are not capable of being represented at *very* large sizes, for their excellence consisting in the perfection of *form*, any distortion would render the picture worthless: one foot is about the extreme height that the Venus de Medicis could be well rendered, with a large triplet, stopped down to an inch aperture, which would imply excellent condition of light. When a group, as the Toro Farnese (the original of which is in a good light), has considerable *depth* in its composition, the facilities given by the greater Sizes possible. Data for dimension.

STATUES, &c. dimensions will be neutralized by that condition. The Roman operators have, however, photographed, with much success, the Apollo Belvidere and Laocoon, &c.—the originals being in vestibules, entirely open on one of their sides to a large court of the Vatican, receive considerable light; long exposures on albumen films, with "stopped-down" single lenses was the modus operandi. Elgin Marbles. The writer found, in copying the Theseus and Ilyssus from the original marbles, that though they were of heroic size, and offered considerable facilities of lines, it was not possible to exceed one foot in dimension. Busts may be attempted to three and four inches for the head if skilfully treated. Single lens inefficient. When subjects of this class are executed with the single lens, a flatness and want of intensity result. No lens, for this purpose, equals the triplet; its correctness of outline and soft delicate finish are perfect.

In modern works of pure *white* marble, care must be taken to *modify the light* by blinds, and to be sure that they are sufficiently exposed, otherwise the gradations of half tones, a principal quality in such subjects, would be lost in flat white masses void of drawing.

Bassi Relievi facile. Bassi Relievi offer much less difficulty to a perfect result, from the shallowness of their depth for focus, and if judiciously lighted the appearance of *reality* with which they can be rendered will find admirers who cannot appreciate their other qualities; indeed, the imitation of a fracture or of the granular surface of the time-worn Common-place qualities. marble, seems often to fix the attention more than

the general forms of a masterpiece of antiquity; but in copying such works the business of the photographer is to omit no precaution which shall secure the representation of the outlines *of the whole* in great perfection, and not *force* attention to qualities which are in common with a piece of ordinary masonry. STATUES, &c. to be avoided.

Bronzes will require much more light than marbles; the eruga on antiques will produce a more vigorous action than its appearance to the eye denotes, consequent upon the *blue* colour frequently present in it; those of the cinque-cento period, that have an even black *dusty* character, present greater facilities: abstain from touching them as every *finger mark* will appear on the photograph. Bronzes: their nature.

The most usual failure in representations of bronzes is the direct opposite of that which takes place with marbles; in the one case flat *white* surfaces appear void of drawing; in the photographs from bronzes *black* patches, without forms delineated on the proofs, from bare glass on the negative, are more usual: this must be guarded against by a considerable reflexion of light from *white*—not polished—surfaces, on the shadow side of the bronzes, and by sufficient illumination and exposure. Failures the opposite to marbles. Remedies.

STILL-LIFE.—Pictures from objects which come under the above denomination are admirably calculated for representation by the camera, and have besides the great advantage of making the student perfectly acquainted with the peculiar qualities possessed by various textures, surfaces, and colours, and the treatment which each necessitates to arrive at a satisfactory result. Desirable for representations and study.

STILL-LIFE. Bright surfaces. The most difficult objects to delineate are all bright and polished surfaces, which reflect *white* light (see p. 12), as armour, fish, &c. The most advantageous are those whose *textures* offer great opportunities for exact imitation, such as animals and birds, carved wood, mattings, &c. In making these studies, it will continually be experienced that objects which are of the *darkest* local colour, Varied textures. will come out light, provided that the structure of their surfaces is such as to present portions to advantageous reflexion of light; thus *smooth* Reflexion of light. black morocco-leather tells as a *dark*, whilst the corrugated comes out *light*. This is a main feature in the action of light on all objects, and governs their appearance in the photographic picture so completely, that the student will find the greatest assistance in his subsequent compositions, from the knowledge he will acquire in Excellent practice. arranging and photographing groups of still-life. Whilst, at the same time, such subjects can be made extremely interesting and picturesque, and, from the imitative power of the lens, will always be looked upon with interest, more or less according as the taste of the composition and grouping is artistic and pleasing by *contrast* of Desirable qualities. *textures*, judicious *composition* of lines, and agreeable *light and shade*.

Although the mere copying of subjects of "still-life" by photography may be considered by many as commonplace, there exists, nevertheless, a great difference in the amount of skill displayed in treating them. The late Mr. Thurston Thompson possessed the power of rendering, with

great excellence, photographic transcripts from such originals as carved ivories, metal chasings, rock crystal, and glass, carved wood, &c. And though not of the most ambitious, such subjects are amongst the most *useful* applications of the art, since by means of them fac similes of objects of great rarity and beauty, jealously preserved in distant and widely separated museums, can be brought in close contact for comparison, study, and the advance of taste and civilisation, and made most materially to assist the progress of art-manufacture of every kind. STILL-LIFE. Valuable applications.

These subjects may be indifferently treated with the single, the triplet, or double, or the orthoscopic lenses. If desired of a size approaching nature, the first, in excellent light or open sunshine, is best. At smaller sizes, the triplet has great advantages, from the finish with which it does its work. Mode of treating.

Having experience of the whole four, the writer would generally prefer the first two, but all are good for different classes of subject, and may be worked at very small apertures, so that the clear definition which, apart from artistic grouping, and judicious chiar-oscuro, constitutes their principal excellence, may be perfect. Instruments.

MEDALS, COINS, CAMEI, INTAGLEI, &c.—It might be presumed that the above objects would come under the same treatment as "still-life." Such, however, is not the case. The very small—often minute—extent of their surfaces, and the necessity which there is to reproduce them of the natural size, as they will not bear reduction, are Greater difficulties;

STILL-LIFE. the obstacles to rendering them by photography. how to overcome The *concentrated* direct light of the sun offers, therefore, the only means of success; but as this means also intense *heat*, it is obviously impossible to apply it to originals of great rarity and value. Taking an impression in wax, and carefully making a cast in the *finest* plaster of Paris, is the only issue from the difficulty. This though, of course, not so satisfactory as a direct transcript from the originals is not by any means to be undervalued, for as their great merit consists in their classical satisfactorily. *design* and *form*, which is thus preserved intact, there is little to regret so long as the forms in the original are reproduced exactly for study, comparison, and book illustration, instead of the diluted, mannered, and often falsely rendered copies by the pencil and graver. An ordinary condensing lens will brilliantly illuminate the *white* surface of the plaster. As *reduction* in size is not desirable, the single lens must be used, or for large medals, camei, &c., the requisite Data for lenses. dimension can be obtained by approaching very near the original with the triplet or any of the double lenses.

In the above manner the writer has succeeded in getting excellent results from the smallest Greek *gold* coins, which, both from their diminutive *size*, and the *yellow* colour of the metal, could not otherwise have been successfully attacked. The gold hemidrachms of Alexander Subjects treated. Magnus—size 1½ Mionnet—the exquisite and rare gold of Tarentum, &c., &c., have been reproduced

as *facsimiles* by photography; the larger sizes of course offer greater facilities. COPYING.

An untrodden field of valuable illustration is here fallow, from such originals. Many persons of good education, who would be greatly astonished if their taste and knowledge of art were for a moment called in question, live in the most perfect ignorance of the very existence of the splendid results of Greek and Roman numismatic art, never, since that period, approached in excellence. Fine copies of the Syracusan medallions; of all the exquisite coins of that great city, and of the other Sicilian and Greek series; the Imperial medals, Roman large brass, and our own Mediæval series, would be most interesting to the lovers of high art, the historian, and the antiquary. For valuable camei, &c., a similar treatment gives successful results. Want of knowledge of fine art.

COPYING PICTURES, DRAWINGS, PRINTS, &c.—Although all objects of still-life present fewer difficulties, artistic and mechanical, than figures, landscape, &c.; taking a really good copy from an oil picture is the *most difficult* and ungrateful of this class of manipulations, from several causes. Oil paintings difficult.

The effect of the colours, as seen in the picture, may probably be transposed in the photograph, and thus a light yellow drapery in the high light of the composition, and a deep blue in the dark portion will, in the photographic copy, produce startling and precisely opposite effects from those which they did in the original, and which were neither intended nor foreseen by the painter. If a highly impastoed picture, the accidental thick- Colours transposed; surfaces exaggerated.

COPYING. nesses of the colours, drag of the brush, &c., show more conspicuously as *textures* in the copy, than even the gradations of light and shade of the painting, whilst inequalities of surface or cracks in panels, will attract more attention than the subject itself. Lastly, pictures by the old masters, or those more recent, when covered with yellow varnish, will refuse to "come out" with any degree of spirit and brilliancy, but remain clouded, obscure, and muddy. The varnished surface is so much exposed to receive reflexions, from any surrounding objects, that, if the greatest care be not taken to guard against them, the subject, in such parts, becomes obliterated in a sheen of light.

Yellow varnish.

Reflexions.

Good qualities;

Still, when really successful, a good photographic transcript from a picture has the greatest interest, as being the actual touch of the painter "in little."

Since the publication of the first edition of this book the writer has had considerable experience in copying pictures both by the old and modern painters; the results are as follows. All pictures by the "old masters" present the greatest difficulties to the photographic action. They are loaded with the accumulated *yellow* varnish of three centuries, which generally opposes an obstinate VETO to a successful result. They are often hung in comparatively obscure corners of galleries whence their removal to open daylight for the purposes of copying is, from their immense value, generally refused; and even when, through the liberality of their possessors, every necessary facility has been given, indifferent or no results have, in most

result of experiences;

instances, been obtained. Several of the Roman Princes have been very indulgent in permitting essays to be made on the "Capi d'Operi" of their galleries. One of the leading photographers of the French school went specially from Paris to Rome making sure of obtaining a copy of the splendid Raffaelle "The Entombment" in the Borghese gallery. Prince Borghese kindly allowed this inestimable work to remain for nearly three hours in direct sunshine,—the result was, NIL. The writer had from the late lamented and enlightened Prince Consort, and from also all the leading London publishers, very numerous commissions to make copies from pictures by the old masters in Rome, Florence, &c. In the Vatican, their removal from their places in the galleries was refused. By the permission of Prince Borghese the portrait, by Raffaelle, of Cesare Borgia—"Il Valentino"—was given over to the writer, and was allowed to be placed in the open air, but the *yellow* tones of the picture prevented a successful result. The "Fornarina" of Raffaelle, in the Palazzo Barberini, gave a little better picture, but still far from satisfactory. In fact, in artistic Rome, with an enlightened liberality on the part of the noble proprietors, the city swarming with photographers, to whom any amount of patient "organ grinding" with dry plates was familiar, and who in the interiors of the Vatican disposed themselves, book in hand, in a semi-somnolent state beside their cameras for a half or whole day's doze or "exposure" *not one* copy from all the great pictures its galleries

COPYING. liberal treatment, and encouragement. Data. No results.

COPYING. abound with, has appeared. The *only* exception is that, made by the writer, from the well-known portrait of Beatrice Cenci in the Barberini Palace. The Prince permitted it to be advantageously placed in the open air, and the tones of the picture being cool, the local colours broken up, and very little varnish on it, a successful copy was obtained, which was by commission from a leading London house, by whom it has since been published. Enthusiastic appreciation of the interest attaching to a really fine and faithful transcript of the very touch of Raffaelle has not been wanting, and every encouragement has been held out for perfectly satisfactory results. A very considerable sum was named to the writer by a London publisher for a large and fine copy of the "Transfiguration," and the amount of commissions from various sources, on this particular subject, was of the most liberal nature.

Guido's Cenci.

Large sum offered.

All pictures, ancient or modern, in which the *local colours* are pre-eminent are the most difficult. Such are Titian, Guido with his blue and red draperies, Paul Veronese, Rubens, &c. Those in whose pictures the *local colours* are made subservient to *chiar-oscuro* are more facile,—Corregio, Murillo, and Rembrandt, *when* the latter has not a *yellow* tone. Large sizes are *much more* difficult than small. It is often possible for the lens to grapple with, and master even the yellowish tones when it is not overtaxed as to the intended dimension.

Data respecting the "old masters."

Modern paintings, fresh from the easel, do not at all oppose insuperable difficulties. Of course the

Recent pictures.

local colour of draperies, &c., are sometimes singularly transposed; but, on the whole, sufficiently satisfactory results have been seen by the public. The late Mr. Howlett devoted a considerable portion of his time to that pursuit. The late Mr. Thurston Thompson also was successful in his "reproductions," so, unless photography is "like a crab and goes backwards," there is no reason whatever that what has once been accomplished should not again be done. Appropriate and powerful lenses are requisite when anything more than the *smallest* sizes are attempted. The new instrument before mentioned, will enable those who attempt picture-copying to ensure better results than has heretofore been possible. COPYING. Successful practitioners.

Double combination lenses are preferable to copy oil-paintings, as they will translate the various tones better, give superior definition, and have a power of greater penetration into all deep glazings, obscure parts, and difficult colours of the original than the single lens; which is inefficient for searching into the difficult tones of the original. A *long-focused* portrait lens is a good instrument; it has the advantages of giving a larger size, has a flatter field, and—on *one line of focus*, which is shallow,—its definition is very superior. These qualities enable it to be used at a larger aperture than a short-focused lens of the same diameter, and render it well adapted for this purpose. With a five-inch diameter of lens and one inch aperture, twenty by fourteen inch size may be readily obtained. Double lens; its power in definition; superior to single. Diameter of aperture.

Mr. Dallmeyer is, however, on the point of bringing out a new lens, which, in the writer's

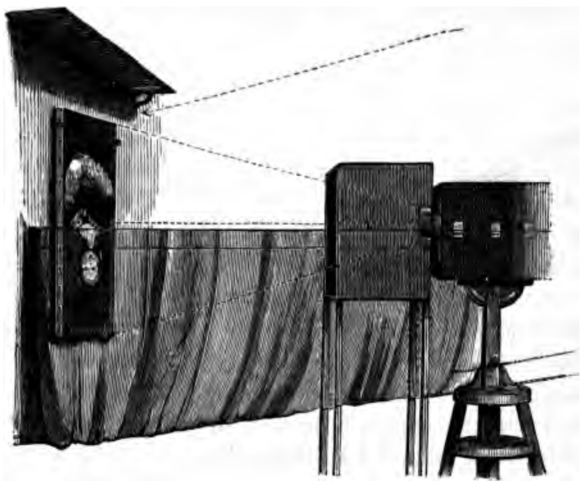
COPYING. opinion, will be the most perfect instrument for this purpose of any yet produced. It is "aplanatic," gives straight marginal lines, commands considerable power of light, and will doubtless prove a great assistance to this very difficult manipulation. The writer has had one recently constructed for him, and is highly satisfied with its performance. See fig. 22, page 55.

New lens.

Quality of light. The light just *out of sunshine* must be very good in order that the most obscure parts of the subject may be perfectly illuminated. Pictures are better copied in the open air, sheltered from the wind, and firmly attached, to prevent vibration.

Precautions The greatest care must be taken to prevent the

Fig. 70.



direct vertical action of light by projecting a

against reflexions, blind *above* the picture, for *one foot* or so, other-

wise the inequalities before mentioned will be very apparent. *Reflexions* from the ground and surrounding objects must be shut out, for which purpose an excellent plan is, that from the lens to the picture, both underneath and at the sides, black *unglazed* calico, cloth, or cotton velvet, should be extended over cords, so as entirely to mask all other surfaces. COPYING. their nature.

The time of exposure given should be considerable, therefore extra precautions will be required against fogging. Large sized pictures present the greatest facilities, the extent of their surfaces radiating more light to the lens, and the reduction which takes place giving better qualities of definition; but from *recent* highly finished works of *small dimension*, very exquisite copies have been exhibited—by Bingham from Meisonnier—which prove the capabilities of photography in this direction. The collodion employed should be in medium condition; not so sensitive as that required for photography from the life, which under the lengthened exposure would be sure to fog, nor in the highly coloured state which is better for copying prints; as it would then neglect the difficult and obscure radiations. For those who copy pictures professionally a lens specially constructed of the quality before mentioned is very desirable. Large pictures. Small dimensions. Quality of collodion.

Prints and drawings in chalks are amongst the easiest class of subjects to copy photographically; unless the *texture* or *colour* of the paper should offer impediments, there are not many points to consider. Chalk drawings and prints.

The print or drawing must be placed *exactly*

COPYING. Requisite arrangements. *square* with the lens, that the copy may be free from distortion. The collodion to be employed is such as would be of a bad quality for portraiture, and for this particular purpose has the advantage of preserving the *chalk granulations* and thin *lines* in etchings, &c., *bare glass*, and giving a *vigorous deposit* on the *blank* portions; a highly coloured long iodized collodion will answer best, the single, doublet or triplet—according to the dimension required—stopped down to the *smallest aperture* that will give a picture will be the conditions requisite, as *extreme* definition is indispensable, and if the original is on *white* paper half an inch to a four and a half inch lens will, *in good light*, give a fine result. Distinct image. The point to aim at is that the *lines* and markings shall be as clear as possible, *black* lines must be *bare glass;* the treatment given in page 120, line 14 *et sequitur*, gives excellent results if skilfully managed, in developing this class of subjects.

Recent results. Quite recently artistic circles have been equally surprised and delighted with the application to this class of subjects of Swan's carbon printing process, whereby not only is the entire permanence of the transcript guaranteed, but the additional advantage is gained of seeing many chalk and other drawings by Raffaelle, Michael Angelo, Leonardo, &c., reproduced in the colour of the original.

Important application. The grandest application of photography to these "reproductions," whether we look at it from the point of view of the inestimable merit and value of the originals, or the scale on which

the process was successfully accomplished, was the copying of the CARTOONS of Raffaelle. Of great extent of surface, drawn on paper in chalk, and very slightly tinted, the difficulties, in this direction, were not nearly so great as copying small surfaces which radiate a weak action to the lens; but the sizes of the negatives were so large that the mere manipulations opposed considerable difficulties to a successful result. Copying Facilities presented

To the refined taste and perfect judgment, in matters of art, of the late Prince Consort, the possessors, in all countries, of transcripts from those *chefs-d'œuvre* are indebted for their gratification. The late Prince Consort.

It was entirely through the intervention of His Royal Highness that the permission, long withheld, to move these unique works from the interior of Hampton Court Palace into the necessary external light was granted. The appropriate scaffolding was constructed in the court-yard, from the designs of the late Captain Fowke, and the copies were taken by the late Mr. Thurston Thompson. The instrument used was a large single lens of French manufacture, the glass plates, thirty-six inches square, were supported in their centre, and worked on a post with a small globe on its top, and coated with collodion in the usual manner. In developing, two assistants aided in pouring the solution over the film, whereby stains were avoided; the fixing was done in a flat bath on which the plate was laid, and the bath was then tilted, the solution thus spreading over the whole surface. The camera—now at Data for lens, and manipulation,

COPYING. South Kensington—is thirty-nine inches square, and twelve feet long, and was worked on a small tramway. The writer is indebted for these particulars of a most interesting photographic manipulation to the authorities of the Department of Science and Art.

detailed.

Mr. Caldesi profited by the opportunity to make equally fine copies, but the promised description of that gentleman's manipulation has not arrived in time before this volume went to press. It is presumed to have been very similar, as he told the writer that the producing instrument was also a single lens, but of Ross's make.

Mezzotints.

Copies from mezzotints require such a quality of collodion as would be used for portraiture, their flat and tender half tones requiring more discrimination than other engravings.

Water colour drawings.

Water colour drawings are not easy to copy, the colours often interfering, as blue skies, yellow and red dresses, &c., and if executed on very coarse paper the grain shows disagreeably, but they are infinitely more susceptible of a successful result than oil pictures.

Method of lighting.

In all cases where *textures* of surface tell too prominently in copying either pictures, drawings or engravings, lighting the original with a powerful *diffused* light *out of full sunshine* is the proper method; by this means, the irregularities being illuminated from *all* sides, their prominence is neutralised; whereas, if placed in full sunshine, a "catching-light" on the top of each protuberance, and a "cast-shadow" beneath it emphasize it to the uttermost.

As large white surfaces occur in these subjects, the film must be laid very flatly, free from waviness, reticulations and all blemishes, which would show more on a blank white portion than in a subject. Should the amateur, desiring to make a copy from an engraving, not be in possession of large sizes of double lenses, it will be better to place the print in direct sunshine, and use the smallest diaphragm possible with the respective size of single lens; very good copies may be taken thus, but they will not equal those by *long focus* double lenses, or the triplet, doublet, and rapid rectilinear. For these subjects pyrogallic developer is better than iron, as it more immediately gives a powerful deposit, whereas "intensifying" the latter to any extent, fogs over what should be clear glass, to give the requisite brilliancy. FAC-SIMILES Lenses and diaphragms.

FAC-SIMILES OF MANUSCRIPTS, EARLY PRINTED BOOKS, &c.—Some of the above offer considerable difficulties to photographic representation, the most intractable being those on vellum, the surface of which offers fewer facilities to the reflexion of light than paper, as is perfectly shown by the examination of both under the microscope. Difficulties.

The *yellow* tinge, given by age and discoloration, of very early examples, are the great hindrances to successful representation, but much may be accomplished by the skilful use of the *double lens stopped down,* lengthened exposures and abundant illumination. Mode of treatment.

This is a very valuable application of the art, as by its means amateurs may from distant libraries

STEREOSCOPICS.

Valuable application.

produce *fac-similes* of unique manuscripts, autographs, and portions of rare books.

The treatment to be adopted and instruments used are precisely similar to those recommended in copying prints and drawings. If from discoloration the subject proves intractable, a more sensitive sample of collodion must be tried; the action once established on the film can be controlled by washing off the developer with water, fixing and redeveloping; the development the same, *see ante* p. 120, line 14 *et seq.*

STEREOSCOPIC PICTURES.—The appearance of actual relief imparted to the photographic image by simultaneously viewing two pictures taken from different points of sight, is so familiar, that we will pass at once to the description of the

Different modes of treatment.

modes of treatment varying with different requirements; presuming that every one must be sufficiently acquainted with the finished results, and the manner in which the pictures are inspected.

Theories on the angle.

The vexed question of this manipulation is the exact distance which should separate the two lenses in taking the picture, and a vast amount of discussion has taken place on this point. Now the real fact is, that like many other matters connected with Photography, there is a limit at which scientific theorem must give place to artistic judgment and practice, if the result is to be a *picture* on the qualities of which, as satisfying

Practical results.

the cultivated eye, the propriety or otherwise of the whole arrangement depends; and if that is disagreeable or inefficient, all the abstract disqui-

sitions possible on this or the other angle will not make it pleasing or correct. For our guidance in the mean time, there is one very simple general rule, which is, that the *nearer* the lenses are placed to the objects to be taken, the *less distance* they should be separated from each other; that is to say, at ten feet from the subject three inches apart would be ample to give a natural and at the same time striking relief. The consequences of giving more, say six or eight inches, would be—first, that it would only be after a considerable interval, and with pain to the eyes of the beholder, that the two pictures would combine at all; and, secondly, when they had combined, all the projecting portions of the subject would be in the most exaggerated relief; the nose of the sitter of portentious length; if sitting, his femur of Brobdignagian proportion; the arm of the chair some ten feet long, for the accommodation of an equally preposterous human limb, &c. Now this is an error which operators have often committed, probably to astonish the ignorant by an appearance of extravagant relief.

STEREOSCOPICS. General rules

Short distances.

Exaggerated angles.

The fact is, that according to the class of objects to be treated, the mode of representing them must be varied; for if such an angle as three inches were applied to a view in nature, the extreme distance being mountains, some ten miles or more from the cameras, the picture would be *flat*, owing to the *insufficient angle* given. For such subjects fifty feet apart is not too much, provided always that the *foreground objects* are not *near* the lenses, as then they would of course

Angle varies considerably,

STEREOSCOPICS. suffer much distortion. Such would be the two extremes—one the nearest approach to an object, the other the furthest removed. All intermediate distances must be managed accordingly, remembering only that in treating a subject a certain balance of distance from the camera should be sought for in the picture, which will make the action of the lenses as homogeneous on the near as on the more distant objects, and that when, as in views in cities, &c., the photographer, from the restricted nature of the locality, cannot retire his cameras as far from the foreground objects as he would wish, it is much safer to give too little than too much angle; since in the one case there will only result a certain flatness in the extremely distant objects, those of the middle distance and foreground being well represented; whereas, if in such subjects *too much angle* is given, the distortion of the foreground will be so great as entirely to interfere with the success of the picture.

With subject, and locality.

balance of distance

Various manipulations.

There are several ways of taking stereoscopic pictures, each of which offers certain advantages, and some are more particularly adapted to the objects proposed to be represented.

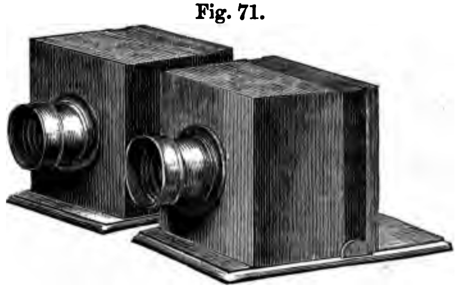
Simultaneous pictures. One camera.

First, then, for pictures *from the life*, or of an instantaneous nature: these will require *two* lenses, which must be *simultaneously* exposed and covered, in order that *expressions* and *effects* may be identical in both pictures. They should be mounted in *one* camera, in which case the degree of angle is limited, but the advantage is obtained of operating on *one glass plate*, and thus securing precisely the same development, &c., in both

pictures, and affording greater facility of manipulation to the amateur. Or they may be mounted

STEREOSCOPICS.

Fig. 71.



in two small cameras, the difference being that, for distant objects, the angle may be increased at which the picture is taken, but *separate* plates are required.

Two cameras

When expensive arrangements and troublesome compositions of several figures are undertaken, it becomes very desirable that the operator should, at one exposure, secure more than a pair of negatives; in which case, instead of two lenses, four can be used *in each* of two larger cameras, the distance from centre to centre of the lenses, vertically and horizontally, being three inches and a half; thus

Elaborate subjects,

Fig. 72.

STEREO-SCOPICS. four pairs at once. Precautions. at each time of arranging the group *four pairs* of negatives will be obtained. It is better to allow a margin for thickened fringes, stains, &c., and take them on glasses eight inches square; the additional security amply repays the extra expense.

Treatment in exciting. With the first mode, *two* lenses in *one* camera, one glass plate and bath suffices. When the *small* plates are used in different cameras they may be also excited in *one* bath by using a glass dipper of four inches in breadth, which will take both side by side. But in this case the operator must, particularly in hot weather, be rapid, or the first covered glass, having to wait for the other, becomes insensitive. The writer prefers *two* baths, and if the plate *first* dipped is the *first* put into its slide the time becomes about the same for both.

Two baths preferable.

Necessary instruments. No lens equals the double combination for the *extreme* and delicate definition which is proper for this class of subjects—which are required to look well *in the instrument*, and therefore in the hand may, if properly executed, for the purpose intended, look both over-elaborated and over-exposed. Double portrait lenses of three inch diameter, six inch focus for large heads down to one and three quarter inch for groups, instantaneous pictures, &c. Wide angle and ordinary doublets according to the exigencies of the locality —for interiors of all sorts. The ordinary single lens for landscapes and views.

Larger heads. When, instead of *groups* of figures, heads of some size (about an inch) are intended, it is more

desirable to employ two *three inch* lenses than to *force* the one and half stereoscopic ones by approaching too near the sitter with them, which is sure to give distortion and weak qualities. STEREOSCOPICS.

Subjects treated by more lengthened exposures can be manipulated in a variety of ways, *one lens* and camera—with a sliding back—will give a pair of negatives side by side at any angle which the operator considers judicious. If a near one, from still life, &c., Latimer Clark's arrangement of sliding laths is excellent, but at *considerable angles* this is useless. Have *two* boards, each with "dowels," corresponding to holes, in the bottom of the camera, screw each board firmly on *two* camera stands—*which are necessary*—focus the subject correctly from *both;* having taken the picture from one, cover the lens, shift the back, place the camera on the other board, and take the other picture. The writer has even used this from the life; three to five seconds will put the camera again to work at the second picture. A better arrangement with such subjects is that the camera should have *two* lenses, one over the other, the advantage being that a *square* plate of two pairs is obtained on the same glass. As has been said, the operator

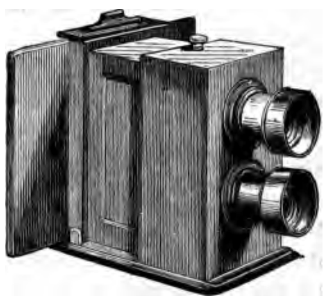
Lengthened exposures.

One camera, *two* stands.

Modus operandi.

Four subjects on one plate.

Fig. 73.



STEREO-SCOPICS. *can,* if quick in his movements, apply this to the life, but for those subjects the *simultaneous* action is decidedly preferable. The ground glass should be *centred* with diagonal pencil lines opposite each lens, and when focusing observe that the subject occupies the same position in each compartment.

Form for groups. The compositions of groups must necessarily be of an *upright* shape to meet the requirements of the stereoscopic form of picture; the artist should endeavour to arrange the subject so as to take the greatest advantage possible of *varying planes of distance,* which will increase the illusion in the picture; consequently it is desirable to diminish aperture as much as can judiciously be accomplished according to light, &c., in order that the greatest possible perfection of focus may be obtained on the different objects; moreover, the *image itself* is more rotund and stereoscopic taken at *small* than at *larger apertures.* (See page 26.)

Small apertures desirable.

Manipulation The manipulation with *two* plates requires some little practice, in order that both may be treated *identically,* and with the requisite celerity; the mode of proceeding is as follows.

described. Both the glasses should be perfectly ready; lay the film on the first, put it in the bath and cover it; proceed the same with the second; after the proper delay, taking the first from the bath, drain it, and put it in the slide, *stand it vertically;* treat the second in the same manner, and at once expose both. "Caps" must on no account be attempted with so many lenses, or even with

Mode of uncovering.

more than *one;* a double black cloth, *carefully* managed—to prevent the access of diffused light—answers very well. INTERIORS.

Returning to the operating room, manipulate the film first excited, before the other; *develope smartly* as the size is small, and time is valuable, wash the plate well, and put it down. Proceed with the second, and endeavour to make both of an equal strength; should the second be slightly insensitive it must be carefully and judiciously intensified up to the *exact* density of the first. For this class of subjects, requiring, as has been said, the highest and most delicate finish, no treatment can at all compete with the development by iron; the subject must be extremely well worked into, no patches of *bare glass,* to which end both the exposure and development must be directed. Mode of developing.

INTERIORS OF EDIFICES, &c.—The most necessary conditions to success in these subjects are the quality of illumination which they possess; and the power, by their dimensions, of sufficiently withdrawing the camera to prevent distortion in the nearer portion of the picture. Necessary conditions.

It is by no means *absolutely* necessary that the subjects should be lighted from the top, although when that condition is found in picture and sculpture galleries, &c., it is *more* advantageous; windows, of some size, in the sides of apartments, churches, galleries, halls, &c., perfectly suffice. One desirable condition is *space to retire the camera.* In cathedrals, with stained glass windows, or a very dark local colour in the stone, success will be doubtful; the operator will find the Top and side lighted. Cathedrals.

INTERIORS. greatest possible difference in the action in those parts of the building opposite the direct influence of the sun and those in a contrary extreme.

Lenses proper. Double lenses are alone to be used for such subjects; when the size of the building and conditions of light permit, pictures with excellent qualities can be obtained up to twelve inches square. The writer photographed the sculpture galleries in the British Museum—some side-lighted—on twelve by ten inch plates, in two and a half to three minutes, with a four and a half double Ross. In Westminster Abbey, the light being unfavorable, it was more difficult to obtain good results; ten to thirty minutes' exposure was required by some objects in north aspects, whilst with those facing the south one minute or so sufficed.

Dimension of pictures.

Data for exposure.

A new power has, however, quite recently been placed in the hands of the photographer by which he is enabled to include a very much larger amount of the lateral portions of a small apartment than was formerly possible. Ross's wide-angle doublet and Dallmeyer's wide-angle rectilinear have made the delineation easy of rooms, which before their introduction could not have been attempted. Next to them the $3\frac{1}{8}$ double Voigtländer, six inch focus—back of lens to film—or seven to *near* objects, with one and a half aperture, is the next best instrument to employ. With it, before the invention of the above lenses, the writer accomplished the interiors at Windsor Castle and Osborne; at the latter some of the smaller apartments offered considerable difficulties; in one or two the camera was retired through an open window

Recent instruments.

Restricted localities.

reaching to the ground, and thus additional space gained and corresponding amount of lateral subject included. These technical difficulties have now all disappeared before the powers of the wide-angle lenses, of delineating such localities. Local colour does not oppose so much difficulty as deficiency of illumination; the interior of St. Mark's, at Venice, is as unpromising a subject to attack as can possibly be conceived. The effect of age on the marble, originally white, of its walls has been to convert them to a deep chocolate brown colour, whilst the yellow tones of the gold grounded mosaics of the domes seem to defy the camera—and so they most effectually would, but it happens that just behind the bronze Corinthian horses over the main entry there is a very large semicircular window without mullions, the glass supported on a thin iron frame-work—thus affording free passage to light—and this window facing the west, the whole power of the Italian sun pours through it in the afternoon of the long summer days, and thus Ponti, of Venice, has produced very admirable pictures, 13×10 inches, in which the Rembrandt-like gloom and rich depth of chiar-oscuro of that most interesting basilica have been better rendered by the camera than they ever have been by any artist whatever. The corridors at Windsor Castle, apparently much easier, may be cited as a instance of difficulty caused by defective illumination. The writer had the greatest trouble to obtain pictures of them 6×5 inches, and only the perfection of the lens employed—Voigtländer's six inch focus, and a very

INTERIORS.

Difficult "Local colour,"

well lighted.

Deficient illumination

INTERIORS. overcome with difficulty. long exposure—four hours, the corridors locked up with the cameras left in them, grinding away with Dr. Hill Norris's plates, enabled him to obtain a satisfactory result. The most distinguished of French stereoscopists gave these very subjects, even at the smaller size, up in despair.

Interiors of the halls of the Vatican have been well executed by the Roman photographers, at Large dimensions, the large size of 17×13 inches; but though interiors the subjects were comparatively easy; consisting of well, although side, lighted galleries, with white marble pavements, columns, &c., filled with sculpture; still they may be cited—especially considering the size—as very successful results. The writer has them before him but is not aware of the size of the instrument used; the work is evidently that of a *single* lens. The process employed, and process. at the date of their production, was albumen, dry process—no other being then used in Rome for such subjects.

So many photographers have successfully executed interiors that it appears almost invidious to cite individuals. Excellent examples for comparison in the folio may be obtained of large, and therefore difficult—sizes, by Bedford, Cundall, Disderi, Jabez Hughes, Prout, the Roman and Venetian photographers.

Lenses and collodion. The collodion and the bath should be as for portraiture, the lenses to use for interiors must depend much on the nature of the illumination; where that is good, doublets—both wide and ordinary angle-rectilinears—may be brought into play; with obscure interiors, only the small sizes of

them, as their diaphragm is small. If *space permits* the rapid rectilinear is a most valuable instrument, which can even be worked at full aperture, or very near it. The angle included is less, however, than the former. Double portrait lenses give excellent results for *portions* of ordinary apartments. Parts of rooms with groups in their ordinary amusements or occupations of reading, music, &c., have been taken from the sizes of 12×10 inches down to stereoscopic size—three and a half diameter, ten inch focus lens for the largest; three and a half, six inch focus; two and three quarters, four and a half inch focus; one and a half, three and a half inch focus; with corresponding facilities of all kinds to the *smaller* dimensions.

ASTRONOMICAL. New lens. Various data.

ASTRONOMICAL PHOTOGRAPHY.—A great deal of special study and treatment, and the use of, or access to, a large and very perfect astronomical telescope, fitted with the necessary clockwork to follow their movements, is required when photographic representations of the moon, planets, double stars, &c., are intended, and a successful result will only be secured by the most patient and untiring perseverance through discouraging failures.

Its characteristics,

The difficulties of solar representation lie in a totally different direction: here no clockwork is needed for long exposures; the overpowering intensity of the light is such, that "solarization" takes place, except when a special contrivance is used to procure the *most instantaneous* exposures; for example, by the quick passage of a mere

and difficulties.

ASTRONOMICAL.

crevice of aperture across the plane of the principal focus of the object-glass or mirror.

The producing instrument.

The perfection of the astronomical telescope governs, in a great measure, the result*—for as it would be totally impossible, by any perfection of manipulation, for the most skilful operator to produce an interesting representation from originals inadequately or faultily magnified, so a very indifferent photographer might show pictures revealing wondrous facts, if the producing instrument were of the calibre of Lord Ross's large reflector.

The first daguerreotype,

The late Professor Bond, of Cambridge, in conjunction with Messrs. Whipple and Black, of Boston, U.S., were the first to fix, by means of photography, the image of any celestial body, namely of the moon, by placing a daguerreotype plate within the focus of the great refractor of the Havard Observatory, of fifteen inches aperture, obtaining thereby a picture of our satellite. This was about 1850. In 1852, Dr. Warren de la Rue took successful lunar photographs on collodion, in ten to thirty seconds, by means of

and photograph.

an equatorially mounted reflecting telescope, thirteen inches aperture, ten feet focal length;

* "Atmospherical disturbances interfere greatly with the sharpness of the photograph, and it is only on very rare occasions that the most photographs are obtained, and then fall very short of the beauty of the image seen by the eye. The reason is simply this, that the eye can see minute objects even while they are moving, but in the photograph the movement produces a more or less blurred image. It is seldom that any object is seen absolutely undisturbed in the telescope."—W. de la R.

he was the first to use the then recently discovered collodion process for this end. **ASTRONOMICAL.** **On collodion.**

For all purposes of celestial photography, whether a representation of planets, or fixed stars, or of the photosphere of the sun are desired, the most sensitive state of chemicals is that found in practice to be desirable, the bath, thirty grains solution of recrystallised and fused nitrate of silver, *just neutral*, collodion of a very *structureless* sample—this is most necessary—carefully decanted, and besides removing fragments from the neck of the pourer, allow a few drops to fall to waste on the floor. Bromo-iodised with iron development, not too much "intensifying," as tending to obliterate delicate and valuable details. Cadmium collodion, for this purpose, though very sensitive, is apt to give a thick film, being subject to crapey and other marks, having, however, one great advantage; which is that however long iodised—within moderate limits—say twelve months, or even more, it is always ready at the shortest notice; whereas the other loses sensitiveness by keeping, requires constant attention, and may not be in first-rate condition at the moment when most wanted. **The chemicals, and collodions.**

Reflecting telescopes appear to give better photographic images than refractors, as they more completely converge all the rays to the same point. **Astronomical telescopes.**

In ordinary photographic operating from the celestial bodies nothing more is requisite than the most *extreme* precautions, of all kinds, which would be necessary to produce a clean negative from terrestrial objects; in exceptional cases,

ASTRONOMICAL.

Suggestions.

however, such as the supreme moments of totality of a solar eclipse, when its short duration, and the excitement which is sure to be present in all those engaged, one point is very desirable to attend to, namely, that a portion of the assistants should be *exclusively* occupied in laying the films and exciting them; whilst, *apart from them,* the other, or others, do nothing but develope them. Thus avoiding the certain *loss of time,* and equal certainty of one operation deteriorating the results of the other.

Appearances of the stars.

STARS are on the films minute points, mere specks. Without a proper driving clockwork, an *irregular* streak appears, the path of the star across the field. If the appropriate apparatus is applied, a congerie of points shows on the negative, according as the atmosphere has produced more or less "flickering."

Actinism of the planets.

Of the PLANETS, Jupiter seems to have the greatest actinic power, being within $\frac{1}{4}$ to $\frac{1}{6}$ that of the moon. Saturn required twelve times longer exposure than Jupiter. In some of the largest telescopes hitherto used his diameter is only $\frac{1}{37}$ of an inch in diameter.

Of NEBULÆ no photographic image has been yet obtained.

The MOON is the one of all the celestial bodies the representation of which is the most interesting and the most complete. Dr. Warren de la Rue has taken a variety of images of our satellite, some of which have borne enlargement up to the diameter of thirty-eight inches. Very perfect stereographs of the varying

Photographs of the moon.

ASTRONOMICAL.

lunar appearances must be in the possession of many photographers—their clear definition leaves nothing to be desired. Photographic images of the full moon have been obtained instantaneously; the usual exposure is four to five seconds; more as a crescent requires ten to fifteen seconds to delineate the portions visible towards dark limb. If taken with the late Lord Ross's reflector, six feet in diameter, the size of the representation would be six inches. Those hitherto taken by Dr. de la Rue are $1\frac{1}{10}$ inch in diameter. It is not desirable to magnify the focal image, but to take enlarged positives on glass. Padre Secchi, of the Osservatorio, Rome, has been very successful in such enlargements, some of which he kindly presented to the writer. Under the microscope, photographic images of the moon gave surprising results—the terraces in the internal walls of that wonderful volcano, Copernicus, his double central cone, the bottom of the crater, all appear, rendered with infinitesimal detail.

Data for exposures, and dimensions.

The appearances presented by the photosphere of THE SUN are daily registered at the Observatory, Kew. The photo-heliograph is $3\frac{4}{10}$ inches in clear aperture, and fifty inches focal length; the full aperture is seldom used; it is generally diminished to about two inches diaphragm, placed in front of the object glass. The telescope clamped in right ascension is placed a little in advance of the sun; on his reaching a central position in the field, defined by wires, a retaining thread is severed by burning it with a match, a shutter having a small slit in it flashes across the

Photo-heliography; mode of operating,

ASTRONOMICAL. film, and permits sufficient light to obtain the image to pass through it.

over-exposure. By over exposure the feculæ first disappear, then the penumbræ round the spots, lastly, the spots themselves.

Solar eclipse, At the total eclipse of the sun in 1860, it being most visible in Spain, various countries sent observers there. A large staff, under the direction of the Astronomer Royal and Dr. Warren de la Rue, &c., proceeded to that country; those whose intentions were to obtain photographic representations of the appearances of totality, stationed themselves near Miranda del Ebro; they were enabled to secure two negatives of the totality, showing the red flames and part of the corona round the dark edge of the moon, which appearances of totality. shut off the solar photosphere from view, leaving the prominences and corona only visible. The moon's image occupied a space of four inches in diameter in the photo-heliograph. A very elaborate discussion of the results of these photographic observations is published in the 'Phil. Trans.,' 1862, pp. 333—416, the memoirs being the Bakerian lecture delivered by Dr. de la Rue on April 2nd. It is therein distinctly proved that the red prominences belong to the sun.

Approaching grand eclipse, A grand total eclipse of the sun will occur in August of the present year, of nearly the greatest possible duration. On the East Coast of the Indian Peninsula, the duration will be about 5½ minutes. Two fully equipped expeditions have started from England, one organised by the Royal Society, the other by the Royal Astronomical

Society. The first under the direction of a son of Sir John Herschel, the second under Major Tennant, who is provided with a nine-inch reflector equatorially mounted for photographing the luminous prominences.

PHOTO-MICROGRAPHY.

photographic preparations.

In undertaking this scientific speciality the photographer must make up his mind to surmount many obstacles by continuous perseverance, there being no hope of a successful result "if he only dabbles in celestial photography in a desultory manner." At the same time nothing can better repay the watchful nights spent over the subject, and the frequent discouragements from failures, than the interesting pictures which have been shown; the results of resolutely grappling with and overcoming opposing difficulties.

Summary.

PHOTO-MICROGRAPHY.—Photography, applied to the microscope for producing enlargement of microscopic objects, early engaged the attention of scientific persons both in this country and abroad, and eventually led to the term Photo-micrography, as designating this particular branch. Of late years an attempt has been made to popularise through the use of the oxyhydrogen lantern in an educational and scientific point of view, and with considerable success, the results obtained by the combined employment of the microscope and photography. Nevertheless in this country it has not gained the favour it deserves; whilst its importance has been fully recognised in America, the apparatus forming part of the laboratory arrangements of the Army Medical Museum, Washington; a description of

Photomicrography,

in America.

PHOTO-MICROGRAPHY. which is to be found in the second part of the catalogue of the Microscopical Section of the United States Army Medical Museum, published 1867.

Successful operators. Many of the beautiful productions obtained there by Lieut.-Col. J. J. Woodward, M.D., and Brevet-Major Edward Curtis, M.D., have, through the kindness of the former, been exhibited in this country by the favour of Dr. Maddox. They elicited universal admiration, and showed many advantages to be gained by its careful adaptation.

It is feared the value of this application will scarcely be fully appreciated amongst us, until some plan be found by which its beautiful results can be easily applied to illustrate scientific literature, more or less after the manner of Its position in England. ordinary printing; the expense and trouble attending the illustration of scientific works by the usual means of silver printing being serious obstacles. Yet the more this branch of photography is made known, the greater will be the chance of its taking a permanent position; therefore, as there are several points of importance connected with its manipulation, we purpose devoting a few pages to its consideration. The subject in all its detail has been so fully treated in the fourth edition of Dr. Beales' "How to Work with the Microscope," published this year, that we shall here only consider it in its practical application.

Different treatments. The apparatus, for convenience, may be divided into two kinds:—One, where the microscope is simply adapted to a camera having a considerable range, in place of the ordinary camera combina-

tion; the camera and microscope being steadily fixed on a firm table or special stand, and arranged so that the sun's rays, at an open window, may fall on the mirror at a convenient angle. The other, where the microscope or special apparatus is arranged on a firm support placed in a dark chamber, with means for admitting the sun's rays to the apparatus, and also performing in yellow light the necessary manipulations connected with the process. We shall describe both of these as applied by Dr. Maddox.

PHOTO-MICROGRAPHY. described.

Select a stout baseboard clamped at each end, of any desirable length, from four feet to five feet and a half, and of a width corresponding to the width of the camera to be employed; attach at the sides of the baseboard two wooden guides, so as to allow the draw part of the camera to slide smoothly between them; pierce one or both of the guides with holes at every half inch, and make a corresponding hole in the sides of the base of the draw chamber for the insertion of a metal pin, by which it can be fixed at the desired range. Draw a central line along the base board its entire length, at one end fix the microscope arranged horizontally, so that its centre may be over the central line, and the centre of the body central with the aperture in the camera; remove the eye piece of the microscope and line the body, its full length, with a smooth tube of cotton velvet. After removing the camera combination close the aperture in the camera with a piece of wood turned to fit the brass ring, and pierced with a central hole lined with velvet or leather, to admit

Camera and microscope combined.

PHOTO-MICROGRAPHY.

the body of the microscope, so that it can slide through the opening by means of the rack and pinion or coarse adjustment. The body of the tube should project into the camera a short distance when racked down to its lowest range. Let the front part of the camera be fixed to the base board by a screw and nut, or in any other suitable manner. The chances are the ordinary bellows camera may not have a range sufficient to meet the full length of the baseboard, therefore some plan should be adopted to elongate this chamber, and at the same time allow the camera to be closed up to within at least a foot of the end of the body of the microscope, for the convenience of arranging and examining the object. Suspend a slight rod beneath the base board parallel with the central line, and fix to its front end a ground wheel equal to the diameter of the milled head of the fine adjustment, and connect the two by an endless band of silk or cotton. This rod should slide easily backwards and forwards in its supports. It may, if preferred, be placed at the side of the base board; by it focusing can be readily effected at all ranges. The greyed glass of the focusing screen should have a very finely ground surface; if possible, place at a short distance in front of it, a blackened card diaphragm having an aperture that will define the boundary of the field, to correspond with the size of the plate to be used, and at the same time cut off all extraneous rays. These diaphragms can be easily made by having the card half an inch larger every way than the interior of the camera, cutting off an

Body of the microscope fixed to the camera.

Diaphragms

angular piece at the corners and folding down the card at each edge to a right angle to fit the camera, so that when placed in the interior the folded sides may spring against the walls of the camera, or they can be attached to a proper frame or carrier. Let the microscope be firmly clamped in its exact position, place a collar of velvet or cloth on the body to slide again on the front face of the camera, when arranged for work. The base board may be supported on three double-widely-centred-triangle legs, and in this way can be easily carried to any window and stand ready for use with little delay. To meet the necessity of a short-bodied camera a stiff card board or metal velvet-lined tube can be fixed over the ordinary camera mount, the lens being first removed, and closed at the other end with a cap pierced for the insertion of the body of the microscope. In whatever way arranged *freedom from all vibration is necessary*. This plan will suit almost any form of microscope that can be placed horizontally. Mr. Highley had a very efficient method by attaching to the camera front a separate stage, mirror and objective with adjustment; also more recently, a very perfect arrangement figured in Mr. Hogg's treatise on the microscope, sixth edition, published 1867.

to cut off extraneous light.

Vibration deteriorating.

If it be proposed to employ the dark chamber as a camera, select any room which faces the sun's apparent path for the greatest portion of the day, close up every part of the window, if large, by a shutter at top and bottom, made absolutely light tight. In the centre of the shutter on a line

A room as camera.

PHOTO-MICROGRAPHY.

Method of preparing described.

parallel with the axis of the microscope as fixed on its base board, let an aperture be made to receive a sliding brass tube about the size of the body of the microscope or larger, and on the outside of the shutter screw a brass rod in the exact position of what would be the continuation of the stem of the microscope if elongated, and on which is to be fixed the mirror; this should be larger or longer than the ordinary mirror, and of finely silvered, thin, well polished plate glass. The mirror can be worked either by the hand introduced through an opening cut expressly in the shutter, and closed by a bag sleeve, or preferably by a couple of rods passed through the shutter, and so attached to the mirror that it can be worked from within; where the rods pass must be rendered light tight, nor must any light be admitted by the side of the telescope brass tubes; the inner one of these tubes will receive the achromatic condenser, ground glass or polarising prism, and at the opposite end outside the shutter, can be hung a narrow glass cell with parallel sides, about $4\frac{1}{2} \times 3$ inches, holding a solution of ammonio-sulphate of copper, for the purpose of obtaining a nearly perfect mono-chromatic illumination of the object. In the place of sliding tubes, long mirror support rods, &c., a small solar microscope mirror, with its plate and rack and pinion for effecting a rotating motion around its axis, can be attached to the inside of the shutter, if small, by its four clamping screws, the mirror projecting outside. The sun's rays can thus be thrown through the body of this solar microscope

Sun's rays reflected.

by working the pinion of the mirror from within. In either case it is necessary the shutter be rendered *free from all vibration*, which, if the surface be large, is not likely to be the case, therefore we would suggest that a moveable upright piece, with the solar microscope body attached, be clamped firmly at right angles to the surface of the base board at the microscope end, the mirror passed through the aperture in the shutter, and the support brought to *nearly* touch the inner surface of the shutter, all side light being excluded by a fixed thick curtain drawn round the right angle upright piece, and beneath the under surface of the base board, so that it may be free of any vibrations given by the wind to the shutter. At the side most convenient have an opening made in the lower shutter (supposing two to be required) to receive a sliding frame holding a pane of yellow glass, which can be darkened by a curtain, or opened according to the requirement.

PHOTO-MICROGRAPHY, Precautions necessary; their nature.

Remove the body of the camera, and in its place use only the draw chamber holding the focusing screen, which should have a short bellows portion, open in front, attached to it, so as to exclude any light reflected from the walls of the chamber, or substitute a special frame, to carry the ground glass. This frame may be made with sliding bars and springs to retain any size plate, up to 8 or 9 square inches, and be attached to a heavy foot or rest, that slides along the base board, and can be fixed at the desired range. It may also have an arrangement for being inclined

Portion only of camera, swing back arrangement,

PHOTO-MICROGRAPHY. at a slight angle from its vertical position, also rotate slightly from either side; in fact, have the movements of a swing back in the ordinary camera, so that its surface may be rendered parallel with the surface of the object on the slide, in case of any deviation. The sides of this frame should be shut in by hinged-like swing, side pieces and a top piece, the latter falling on the former, and having a flap curtain or diaphragm with a central aperture in front. The object of these is to cut off side light, and when thrown back, to permit examining closely the surface of a fine card, substituted for the ground glass, and on which the image is to be focused, an ordinary magnifying or reading glass being used for greater accuracy. This latter method has, we believe, many advantages; one is, the facility of focusing and attending to the mirror, another, the advantage derived often from the general appearance of the object as seen on paper, &c.

for use if requisite.

Method of focusing

introduced by Mr. Wenham.

Mr. Wenham first described the use of a card surface to focus upon. From these general observations we may pass to the actual use of both these instruments, taking the former first.

After arranging the apparatus for employment at an open window, selecting a suitable object and attaching the objective, throw the sun's rays through the instrument on to the ground-glass screen, either from the plain surface of the mirror or an achromatic prism, and see the various parts of the instrument be duly centred; now insert the achromatic condenser and the object slide, close up the camera, bring the object into focus

Mode of operating,

PHOTO-MICROGRAPHY.

by the rack and pinion, see the collar round the body of the microscope *abuts closely against* the front of the camera, and now arrange the condenser so as to give an equally illuminated field or disc on the focusing screen, at the same time that the object be brought into its proper position. Now withdraw the camera to the range required, and fix it; cover the whole, except the mirror, with a dark cloth, and bring the object into perfect definition by the use of the focusing rod, using a Ramsden's positive eye-piece for examining the image or a proper focusing glass. Attend carefully to the position of the achromatic condenser and its stops. Have ready a prepared wet or dry sensitive plate, shut off by a blackened card or any other suitable manner, the aperture of the condenser nearest the mirror or prism, remove the focusing screen, insert the prepared plate, lift the shutter carefully under the covering cloth, wait a few seconds for all vibrations to cease, snatch quickly away the blackened card, and according to the intensity of the illumination, the kind of condenser employed, the colour and density of the object, the power of the objective and the range employed, so must be the exposure. This may vary from instantaniety to thirty or even more seconds, and can only be learnt by practice. Replace the card, close up the shutter of the dark frame, and proceed to develope the image by any of the methods with which the operator may be accustomed; always remembering the purpose for which the negative is intended, and that you are dealing with an image taken

Precise data.

The sensitised film.

Time of exposure.

PHOTO-MICROGRAPHY.

with the rays of the sun strongly concentrated. The chances are you will find the image not to correspond in definition with the image seen on the focusing screen; this will be most probably due to want of coincidence between the chemical and visual rays transmitted from the object-glass. In the high powers this may be *nil*, but in the lower powers will generally want correction. Note the graduation at which the fine adjustment now stands, and observe the part of the object most truly defined in the negative. Proceed to re-focus the object until that part be equally defined on the ground-glass, and then take another negative with this alteration; if successful now, the number of graduations between these two points will give the amount necessary for the fine adjustment to be withdrawn after obtaining the best focus for that object-glass at that range.

Non-coincidence of foci.

Mode of obtaining coincidence.

If the end of the rod nearest the operator be made to carry a graduated circular disc, the parts of action necessary to obtain the correct actinic focus can be easily made, without looking each time at the graduated milled head of the fine motion. If, as adopted by Drs. Abercrombie and Wilson, the focusing be made by means of a long lever attached to the pinion wheel of the coarse adjustment, the fine motion can always be left to obtain the actinic focus, by making the necessary correction for each object-glass. With some of the low powers, a fine spectacle lens (of ten to fourteen or sixteen inches focus) turned down, fitted to a cell, and screwed into the back of the objective in place of the diaphragm or stop

Other methods

will, if properly selected, usually bring back the correction of the object-glass for the purposes of photography, and but slightly impair the definition. It can, indeed, after focusing, be removed, but the chances are the illumination will have altered and require to be re-effected, which is somewhat difficult, when the object is out of focus, which it would then be.

PHOTO-MICROGRAPHY described.

To obtain the best result it is necessary to attend carefully to the correction for the thickness of the covering-glass; with the medium and high powers this can be done at the microscope, using the lowest eye-piece.

If an object having several distinct planes be first selected for trial, the actinic correction can be more easily noted: even when the ammonio-sulphate of copper cell be used, it is best to attend to these two points.

Ammonio-sulphate cell.

This cell should have parallel surfaces and be supported against the end of the condenser, *i. e.* between it and the mirror.

When objects have small irregular surfaces, there is often, under sunlight, much diffraction or interference, which occasions the edges or dots to be duplicated and false appearances produced; to avoid this, the rays from the condenser or from the collecting lens are allowed to fall within the focus, or a surface of glass finely ground on one or both sides, according to the requirements, and then this highly-illuminated spot is made the radiant for the illumination of the object. This materially increases the length of the exposure with powers over the one-fourth or one-fifth.

A mode of illumination.

PHOTO-MICROGRAPHY.

dark room prepared.

We are now prepared to use the dark chamber as the camera, and shall suppose the base-board to have the upright piece firmly fixed at right angles on the microscope end, carrying the mirror and body portion of a small solar microscope—the camera itself—removed, and the carrying-frame or shut body substituted in its stead. Throw up the sash, bring the stand very nearly close to the shutter, passing the mirror through its aperture, draw round the curtain attached to it, darken the room entirely to all extraneous light, draw the curtain over the yellow pane of glass, close the opening of the body of the solar microscope, and examine well there be no leakage of diffused light from any unclosed aperture. Now turn the mirror and throw the sun's rays on to the focusing-screen or card inserted in the frame, and see all *parts are duly centred.*

Various precautions

By means of the sliding frame in the shutter, hang the ammonio-sulphate of copper cell outside; if the arms of the mirror do not interfere in their rotation with its position, if so, use a screw-cell with parallel surfaces, and insert it into the outer end of the body of the solar microscope. A diaphragm should project beyond this cell, so that the sun's rays cannot fall on its surface, save those reflected from the mirror. Insert the achromatic collecting lens, also the ground-glass if needed somewhere within its focus, for if at the exact focus the chances are it will be fractured by the intense heat, and now couple the ordinary achromatic condenser with the body of the solar microscope, so that there shall be no leakage of

against intense heat.

light at the sides. To accommodate for the length of the body or tube of the solar microscope, the microscope will most likely have to be shifted back a few inches. Screw on the objective, place the object-slide on the stage, throw the light from the mirror through the apparatus, and proceed to carefully adjust the achromatic condenser so as to obtain an equally illuminated field on the card or focusing-screen. Dr. Maddox gives the preference to the card. Cover the stage of the microscope with the dark cloth, to prevent the light, reflected laterally from the slide, being diffused in the chamber. It is well also to place a card diaphragm about midway between the end of the body of the microscope and the focusing screen to define the field; this can be supported on a short pedestal or foot, or in any convenient way preferred.

PHOTO-MICROGRAPHY.

Precise data in operating

After obtaining the best appearance of the object on the card or focusing glass, lay a piece of blackened cardboard against the mouth of the microscope; remove the focusing-screen, insert the prepared plate, which should be kept ready drained in a dark box, snatch away the blackened cardboard, give the necessary exposure, replace it, slightly turn aside the mirror, draw back the curtain that was over the yellow pane of glass, and proceed to develop at once. These are the two plans adopted by Dr. Maddox with but very trifling modifications, to suit particular purposes.

given by Dr. Maddox.

For further particulars as regards the history of this branch of photography, the method adopted by various operators in this country, on the

PHOTO-MICROGRAPHY.

Summary.

continent, and at the Army Medical Museum, Washington, the use of polarised light, the production of stereo pictures, the employment of the highest magnifying powers, the reproduction of positives for the oxy-hydrogen lantern, and for notices of the literature of the subject, we must refer our readers to these articles in Dr. Beales' manual, 'How to Work with the Microscope,' 4th edition, 1868. In this book will be found numerous illustrations on this subject, and a full statement of his theory of development and growth, accompanied by excellent woodcuts of appearances of microscopic objects, as seen under the highest magnifying powers in use.

PART V.

PRINTING PROCESSES.

Those who have long practised themselves, or have taken an interest in the progress of this wonderful art, will remember the rude check given to "public confidence" when the fact of the instability of the prints became notorious. Dilettanti who, till that time, had paid liberally for choice examples, were at once deterred from furnishing their folios with such evanescent favorites, the loss of each of which was the more lamented in proportion as its beauty and completeness had been admired.

Printing.

Results of instability.

An art whose ultimate results stand in dubious estimation, will never draw into the ranks of its professors those whose artistic knowledge would develope its great capabilities, and raise its status from the mere "mechanical" process—which, very unjustly, has been its designation—to its proper attribution as the translator of the feeling and thought of the individual directing its powers.

The "printing processes," therefore, are of vital importance to the future of photography, and those who desire its advancement should hail with satisfaction the announcement of the perfecting of one which promises to resuscitate the drooping interest in the art, which the fading of the print had mainly originated.

Importance of the printing.

PRINTING.

Carbon process.

It appears to the writer that by carbon printing a result so desirable is attained, and that in numerous applications of photography, such as book illustration, whether it be for historic, scientific, pictorial, or other representation, a vast field presents itself to its wondrous facility of rendering objects with a finish and delicacy with which it is hopeless for the burin of the most accomplished engraver to compete. Whilst in those directions in which it has previously largely utilised the feeling induced by renewed confidence in the complete permanence of the print, will still more increase the patronage already bestowed upon it.

Swan's patent.

In describing "printing processes," the writer feels, therefore, that although carbon printing is the youngest and last, it must, in description—from its valuable qualities—take precedence of its seniors. The following are the practical details of Swan's patent process of photographic

PRINTING IN CARBON.

Sensitising solution.

Sensitising the Carbon Tissue.—The sensitising solution may consist of one part of bichromate of potash and twelve parts of water. If hot water is used to dissolve the bichromate, the solution must not be used till quite cold. If the temperature of the solution is much over 60°, the gelatinous coating of the tissue is apt to "run." The solution may be used in a flat earthenware dish, such as is ordinarily employed in preparing photographic paper; or, if for large

sheets, the trough may with advantage be deeper, and if more convenient, be made of wood, lined with marine glue. It is a great advantage to have the trough considerably larger than the sheet, and an abundant supply of the sensitising solution. The sheet of tissue is best immersed with the face upward. The operation should begin by deeply immersing one edge, and then the entire sheet should be drawn in under the liquid. Not one air-bubble need be formed on the face, but they cannot be avoided on the back (unless the back be wetted, before immersion, by brushing the sensitiser over it); therefore, immediately after immersing the sheet, turn it over, and brush the bubbles away; this having been quickly and neatly done, the sheet is again brought face up, and is repeatedly drawn in under the liquid as before. This manipulation must be continued until the tissue acquires a certain degree of limpness. American clips are then attached, and the sheet is gently and slowly raised out of the trough, so that the liquid may drain off the face of the tissue without forming into streams. If the sheet is large, it will require to be supported by a thin slip of wood, placed along its upper edge, and clipped to the sheet; or it may be laid (back down) on thin muslin, stretched on a frame placed in a sloping position. The tissue generally requires to remain about two minutes in the sensitiser, but the condition of the tissue as to limpness is a better guide than counting minutes. If taken out too soon, the tissue will not be very sensitive: if left in too long, it will

Nature of troughs.

The sheet immersed;

time necessary.

PRINTING. become so heavy and tender that it cannot be suspended by the clips. The sensitising must, of course, be done in a dark room, and, as the tissue is three times as sensitive as silvered paper, unusual care must be taken not to expose it to daylight.

Precautions to observe.

DRYING.—The place where the tissue is put after sensitising must be *dark* and *dry*. *It is essential that the tissue should dry quickly,* yet the drying must not be accelerated by heat, unless the temperature is very low. There should be a good current of air in the room, and the tissue should be placed in the way of the draught. A desiccating box, containing quicklime or chloride of calcium, may, in case of need, be made use of, but with a well ventilated drying room there is usually no necessity for that. *If the tissue is made sensitive in the evening, it must be dry by next morning;* if dry before then so much the better.

Mode of drying

EXPOSURE.—*The tissue must on no account be placed on a negative while it possesses the least tackiness.* If used in that condition, there is a risk of adhesion to the negative, and the print will be spotted with dark patches. Both these evils are prevented by using the tissue quite dry, and by having the pressure in the printing-frame light and equable. Before placing the tissue on the negative, it is well to brush a small quantity of finely powdered French chalk lightly over the surface; this tests the condition of the tissue, instantly showing if there is any part unduly damp, also diminishing the tendency to the dark patches mentioned. There should, of course, be

and of exposure.

the merest trace of chalk dust left on the tissue when it is used. PRINTING.

The time of exposure may be roughly stated at one third of the time required for ordinary silver printing. If the tissue has not absorbed its full quota of bichromate, it will be less sensitive, and will require a much longer exposure than if the tissue had been allowed to absorb more of the bichromate solution. The printing is, as a rule, best done in diffused light. Greater brilliancy is obtained by sun-printing, but if the latter is resorted to, great care is required to guard against the adhesion of the tissue to the negative, as a consequence of the negative becoming warm. Time requisite. Sun and diffused light.

COATING WITH CAOUTCHOUC.—After the tissue has been taken from the printing frame, it must be coated with solution of caoutchouc in benzole (about twelve grains per ounce). This solution is used in a flat trough. The tissue is trailed over the solution, so that only the face comes into contact with it; the back being kept clean. After draining, the tissue is suspended for an hour or more; the benzole will then have completely evaporated, and a thin film of india-rubber will be left on the face of the tissue. The extreme edge of the coated sheet must now be cut off all round with a pair of scissors; the strip cut off need not be more than one eighth of an inch wide. The tissue must not be fingered, especially after coating with caoutchouc. Method of manipulating

The next step is to lay the coated face of the tissue down upon a piece of caoutchouc-coated

PRINTING. paper, the two surfaces being brought into contact, so that no air is inclosed. When this is done, the tissue and paper must be pressed tightly together by means of a photographic glazing or copper-plate printing press. Whilst pressing, the tissue should be laid on a smooth plate, a felt cloth being at the back. Unless pretty heavy pressure is used, blisters will occur in developing.

Use of presses.

DEVELOPING.—After the operations described, the tissue is immersed in tepid water; from 80° to 90° Fahr. is sufficiently warm. After the lapse of ten minutes or thereabouts, the paper which formed the backing of the tissue must be removed. There is no necessity to use much force in doing this, if sufficient time is allowed, and the tissue is of the proper degree of solubility (such as it will be, if it was quickly dried and is fresh), the backing will come off very easily. It is not desirable to attempt to remove it prematurely; but neither is it well to leave the backing on after it is easily removable. When the backing is removed, the development of the print will proceed rapidly.

Removing backing.

With tissue in a good condition the print will be fully out and clean in a few minutes after uncovering. Several prints may be developed in the same trough, but they must not be crowded together, nor allowed to chafe one on the other. The face of the print should be downward during development. Every print must be quite immersed, and no air must be under them. As each print becomes clean, it should be transferred to a

The time requisite.

PRINTING.

trough of cold water, any that appear lightly exposed being first attended to. The prints should remain immersed at least three hours, in order that the soluble salts of chromium may dissolve out. Prints that are fully developed at first, only require a slight final rinse in tepid water after they have remained the specified time in the cold water bath. The more deeply printed impressions are treated with warmer water, and are allowed to remain in it until they are sufficiently light; they are then hung up to dry. Over-exposed prints may often be recovered by subjecting them to the action of hot water for several hours, but very hot water should never be used except in such a case. The lower the temperature at which the development can be effected the better. By keeping the temperature of the first developing bath as low as possible (say 85°), a shorter exposure suffices, and prints that would have been destroyed by water at 100° are successfully developed at 85°.

Immersion in water.

Treatment if over-exposed.

COATING WITH GELATINE.—The prints, after having become dry, or nearly so, are floated upon a solution of gelatine and glycerine, consisting of one part of glycerine, four parts of gelatine, and forty parts of water. The solution should of course be used hot, and the greatest care should be taken that the coating is uniform, and free from air-bubbles. When the coating is dry, the prints are ready for the retransfer operation. This is performed by placing the print, face down upon a sheet of wet paper, and passing it through a copper-plate press. The paper is best wetted

Data for solution.

PRINTING. by immersion in water. Several sheets (wetted separately, and carefully freed from air) may, whilst fully immersed in the water, be placed one over the other, and be drawn out of the water in a pack, and so hung up to drain. It is an important point to have the paper evenly wetted, and wet to the proper degree when it is used, and also that the gelatinised surface of the print should not be fingered, or in any way soiled. The paper should not be quite so wet that the water stands out on the surface, but it should be wet almost to that degree. The print should be laid on the wet paper, slightly rubbed into contact; it then should be quickly reversed, and laid on the steel bed of the press; the blanket (of thick felt) should then be brought over the wet paper, and the press "pulled" with heavy pressure and a steady, slow motion. After pressing, the print, enclosed between two papers, is passed through a solution of alum, and is afterwards rinsed in water; it is then suspended to dry, and when thoroughly so is ready for the final operation, viz.:

Wetting the sheets, and pressing.

REMOVING THE CAOUTCHOUC PAPER.—To effect this, the paper is slightly moistened with benzole; this so loosens the attachment of the caoutchouc paper to the print that it can be easily stripped off. The paper should be merely moistened with benzole, and no time should be lost in removing the paper after the benzole is rubbed in. Before attempting to remove the paper, it is best to commence the separation by running the point of a blunt knife between print and paper, along one

Mode of removal.

side. If the retransfer has been perfectly done, the attachment of the print to the paper will be so strong that they cannot be separated (unless wet) without the face of the paper tearing. If there are any air-bubbles in the gelatinous coating, or if the coating has been soiled by fingering, there will of course be a want of adhesion of the print at such places, and those points of the print will tear up in the act of removing the caoutchouc paper. The caoutchouc paper adheres to the print with such tenacity as thoroughly to test the adhesion of the print to its final basis.

PRINTING.

Damaging conditions.

SILVER PRINTING.

In order that the print resulting from the previous labours of the photographer may be satisfactory it is necessary that great care and attention should still be maintained and extended to the *printing* from the negative, since if it is carelessly or unskilfully executed not only is the permanence of the resulting print, or positive, jeopardised, but its *very appearance* is most inferior, and *totally different* to what it would have been had proper skill and pains been bestowed on its production, so much so, that it might be difficult for a bystander to believe that two pictures, differing so completely in their quality, could have been produced from the same negative; and it too often happens that from unskilfulness, neglect, or the *parsimonious use of expensive chemicals*, the photograph is deficient in permanence, and a

Great care required.

Results of negligence,

and parsimony.

PRINTING. well justified hesitation and doubt of its powers of duration is created.

Quality of permanence, The impression of the writer is that if all the printing processes are properly and carefully conducted, the photograph, with moderate precautions against atmospheric influences, is entirely capable of perfect preservation. The proof of the foregoing assertion is in the writer's portfolios, which have not been at all closed from atmospheric influences by any extra precautions. Indeed many of the mounts show lamentable access of London dirt and atmosphere on their margins; notwithstanding which, not one of those printed by the process which in the former edition of this book the author advised his readers to adopt, its proof. shows any deterioration. If, then, ten or twelve years having elapsed since the production of some of these prints, they are in such preservation, what should prevent their continuing unaffected, under moderate precaution, for very much longer periods.*

Desirable qualities. THE PAPERS which, at the present time, possess the most desirable qualities are "Rive" and "Saxe." They are both made of different thickness and surface to meet diverse requirements. For small works such as cartes de visites, stereoscopics, &c., in which the greatest unity and Rive. smoothness of surface is desirable, "Rive" is

* The writer must refer to the various possessors of prints of his earlier works for verification, or otherwise, of the above. He has recently shown to numerous friends the *unaltered* proofs —amongst others to the esteemed editor of the Photographic News.

generally preferred. For larger dimensions "Saxe" possesses greater depth, mellowness, and richness in the prints taken on it. Great *evenness* of texture, when held up to the light, and absence of small holes, and of iron spots (arising from the trituration of buttons, rings, &c., in its manufacture) are what it is principally desirable to observe.

PRINTING. Saxe. Points to observe.

TO EXCITE THE PAPERS.—The photographer must be careful that the exciting solution is of eighty or even 100 grains of nitrate of silver to the oz. of distilled water; otherwise the prints will be weak in the depths. With the above strength one minute or so suffices to "excite" the paper. The results are better than a more lengthened floating on a sixty grain solution; but the original strength must be kept up by addition of fresh crystals of nitrate as required.

Strength of solution. Time of floating.

The exciting solution should be kept in a dark place; and when much discoloured, it may be cleared by shaking it up with kaolin, which is kept by the vendors of photographic apparatus. The student is cautioned against the use of animal charcoal, sometimes recommended for this purpose, as it communicates a solvent quality to the nitrate solution, which dissolves the greater part of the albumen from the surface of the prepared paper, thus totally unfitting it for use. A *slight* degree of discoloration is of no consequence, as the fixing hypo. sol. subsequently removes it entirely.

Kept in the dark. Purified by kaolin. Result of using animal charcoal.

A glass tray or dish is the *only* proper vessel for this solution, which should be an inch deep in it.

Proper vessel.

PRINTING. The papers are to be ***floated*** as before directed, and with the same precautions against bubbles. Manipulation. The sheets should be removed with horn tongs kept *specially* and apart for the purpose. They should be held *over the dish* for a short time to drain; as, if *immediately* pinned up to dry, a Precautions. long streak of stain will drain from the pin, its brass having been acted upon by the abundant moisture.

Care must be taken that no streams or drops of solution get on the wrong side of the paper, in preparing it; as they will cause stains of increased Mode of keeping. action in the finished proof. As soon as dried, the excited papers should be put away from atmospheric influences in a close drawer; and the sooner they are used the more silvery the tone of colour obtained will be.

To PRINT FROM THE NEGATIVE.—The negative State of negative, having been carefully varnished, and some twelve hours allowed to elapse, in order that any thickened fringes may be quite hardened, the next process is to print it. The excited paper will require strictly keeping from light and air, especially in hot weather, when even a few hours suffice to decompose its surface; therefore, when the best results are desired, it is indeed better that the paper should be excited only when it is going and paper. to be immediately used, dried before a moderate fire, printed at once, and toned as soon as possible afterwards. The photograph will have infinitely purer whites, more brilliant darks, and is less liable to part with, or alter, its half tints, in the process of toning.

The printing presses, or pressure frames, are made of various patterns. See that no particles of grit or dust remain on the glass, nor on the back of the negative, and place the latter in the frame, the subject side towards the paper; remark that it has no flue, &c., upon its surface, place the excited paper evenly upon it, put in the blotting papers, flannels, or felt—whichever it may be furnished with—and the back, and screw gently and evenly down.

PRINTING.

Precautions with the printing frame

Now, according to the *quality* of negative which is being printed, the *manner* in which it should be printed, to secure the best results, depends—if the negative is slightly under-exposed, whereby the darks are a trifle more bare than they should be, and the deposit on the high lights more opaque than could be desired, printing in the *sunlight*, at a right angle to the position of the sun, will be the best; for the reason, that the action being more penetrating than printing in the shade, the direct sunray will, in a greater degree, strike through the opacity of the deposit on the high lights, and tend to give drawing in them, and half tones; whilst, at the same time—the action being very rapid—the extreme darks will *yield* a little in the toning process, and not being so black as if printed more slowly, a more agreeable balance will be established in the picture. A negative of this description is capable of giving thirty proofs in a summer's day, and is the most rapid printer that we know. The *print* is not the most perfect—its faults are that there is a certain harshness and crudity in it; the high lights and

and negative.

Varied treatment necessary,

according to their *quality*.

Slightly *under*-exposed.

PRINTING. darks are in too violent opposition, and are wanting in breadth of effect and atmosphere.

Perfect. The next, and the most perfect negative, is more transparent in the high lights of the flesh, and even white linen, when viewed by transmitted light, is not quite an *opaque* måss, but has markings and drawing all over it, whilst the gradations of tone from white to black are beautifully depicted, and full of charm; extreme blacks, not being fogged, but still drawn in a little by forms and reflexions,—such a negative would suffer

Injured by sun-printing. considerably by being sun-printed; the effect would be to give it a general muddy appearance, because the delicate tones and high lights, although quite sufficient for judicious treatment, would be struck through too violently, have lost rotundity, sharpness, and brilliancy, and the darks not having had time *gradually* to take their best vigour, would be vapid and weak; whilst the intermediate tones would have lost their correctness of gradation, and have been much deteriorated. This class of negative should be printed in the shade, lying flat, upturned to the sky; it is not nearly so rapid as the former, about eight to twelve proofs per diem being all that can be had from it in fine printing weather.

Over-exposed. The next sort of negative is that which is *fogged*, not by having been exposed accidentally to diffused daylight in manipulating, but by *over-exposure* in the camera; we must make this distinction, because, in the first case, the fogging is merely a veil drawn over a very weak image, and contains *no drawing in itself;* whereas, in the

second, the film, although thickened, and rendered thereby very obtuse to light—consequently long to print—contains *the drawing of the subject* of which it is the reflex, and on sufficient printing, its forms will appear, and it will have some good qualities, although it can never have equally correct gradations of tone, nor be so bright and perfect as the last mentioned.

Subject exists in the film.

Such negatives are well printed in the sun, remarking only that, as they will require much time to print them, the prolonged exposure to its direct action on a summer's day will be apt to generate so much heat between the glasses that the varnish of the negative may adhere to the paper, and, on the removal of the latter, the subject be injured; to avoid which, in this class of negatives, it is well to remove them occasionally into the shade for an interval to cool. Such a negative is the slowest to print—three or four in the day being about the limit in fine weather.

Danger of prolonged sun-printing.

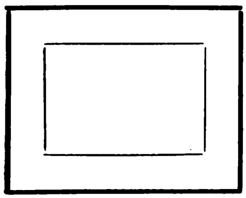
We have now treated of the three classes of negatives which, with slight modifications, represent those which are capable of being printed from, without any touching or "doctoring," and which consequently are the only ones which any operator who values his art will tolerate; still it may happen that, from defective conditions of light, &c., a subject rare or valuable in itself may not have been so well obtained as could have been wished; and in order to enable the operator, without *touching* upon them, which *cannot be*

Mode of printing a defective.

PRINTING.

allowed under any circumstances,* to draw out the forms which exist in the film, without abolishing, from over-printing, those which have been too lightly impressed on the negative, the following expedient is given:—

Fig. 74.



Moderating the light on parts.

Having perfectly cleaned the glasses as directed, place the negative in the centre of the press; take thick mounting-board, and, cutting it by measurement thus, the outside edge fitting the press, the inside the negative that is being printed, the effect will be to keep the latter always in one place —having done this, take a proof of the subject. We will suppose a large portrait in which the hands, face, and white linen are too opaque compared with the dress. Now, if printed in the ordinary way, one of two things must occur: either those parts must be white if the dark dress is right; or the latter must become an uninteresting black mass, if the former are sufficiently printed up. Yet, observe the drawing *exists* in the film; we only interpose a blind to *retard the action* of the light, and in no way attempt abortive touchings on the subject. Take this proof,

Method described.

paste it on a sheet of thick mill-board, cut out the white parts, and take care that the outside fits to the sinking of the *front* of the press, and corresponds exactly with the parts of the subject

* It, however, now seems pretty extensively practised, both in portrait and landscape, as elsewhere noticed.

desired to be advanced; only *rather smaller all round,* as the light spreads under the thickness of the two glasses. TONING.

The subject must be *strictly printed in the shade.* Now, by exercising some judgment, the white parts are allowed to print in advance of the rest as much as is necessary—say one-third or one-half the time necessary for the completion of the subject; then removing the blind, let all go on together. The subsequent printing will entirely obliterate any edge that may have formed; and being open, will have more spirit in the darks than a blind of waxed paper cut through in parts and fixed to the back of the negative, as is sometimes practised. The result, of course, is not to be compared to a *perfect* photograph, such as should be the sole aim of the operator; still, *not being touched* upon, it may sometimes be had recourse to, in order to save a valuable subject. In all these printings, the depth of tone to look for must be considerably more than is desirable in the finished proof; whites must be half tints, and the sitter must appear a mulatto at least, leaving it to the toning process to reduce these excesses of colour to their proper limits. As the proofs are taken out of the press, put them quickly away until they are toned, which is well executed as soon as possible. A large book of *clean* blotting-paper is good for this purpose, as it preserves them more securely.

Must be shade printed.

Better than paper screens.

Appearances to look for.

Precautions until fixed.

TONING THE PROOFS.—Should it not be convenient to tone the prints immediately on removing them from the presses, as before mentioned,

TONING. *great care* must be taken to keep them from the influences of light and atmosphere; the more so if in a hot climate, or during warm weather. Indeed, in either of these extremes, it will be found more satisfactory to tone and fix the proofs immediately. If this precaution is not taken, a deterioration in the colour of the white portions will infallibly ensue; instead of a pure, silvery quality, they will acquire more or less of a disagreeable foxy hue. Having poured out the three solutions, and added to the toning one the quantity of chloride of gold described in "TONING BATH"—strictly in the manner there stated, and having stirred and mixed the solution with a glass rod, take one of the prints by two of its corners, quickly lay it face downwards in the bath, gently press it under the liquid with the horn tongs; now draw it through the solution, and laying it face upwards, examine it minutely, to be secure that it is free from air-bubbles, and that the whole of its surface is wetted; turn it face down again: proceed with the next; and so on.

Better toned immediately.

Mode of manipulating.

Few toned at once.

If good prints are desired, avoid having too many of them toning at once. If they are crowded, or the quantity of liquid is scanty, some are sure to suffer by inequality of tone. They must be constantly kept in motion, the more so, even to continuous manipulation, the better the result. Not only do they thereby avoid reddened patches of unequal action, but they tone quicker, part less with their colour in the lighter shades, the half-tints, and have more brilliancy and intensity in the darks. Do not fail to look frequently at the

advancing tone of colour they are acquiring in the bath, which will be much more rapid as the temperature is higher, and slower when it is low. Before they are *quite* as cool in tone as desired, remove them to the *second* hyposulphite or clearing-bath. After they have been in that for five minutes or so, hold them up to drain off superfluous moisture, and pass them at once to the *fixing* bath, in which they may remain from five to ten minutes, according to temperature. Upon the employment of a perfectly *clean solution of hypo* for fixing the proofs, their *stability*, and much of the *beauty of their appearance*, depends. As its action continues, it will be observed that the light portions, which were yellow in colour, will, as the components of the toning-bath are removed from the texture of the paper, become pure and white; and on the perfect removal from the paper of those metallic and chemical combinations—*soluble*, and capable of entire removal *by the clean hypo*, but which, if left unremoved by it, the *mere water* in the next process would have been inefficient to touch—the stability of the finished photograph depends, the proof of which is easy, by washing a print direct from the toning-bath and marking the result. The *pure hypo is soluble* in water; and, though penetrating in its nature, can be entirely removed, by judicious washing, from the paper. The infinitesimal division of the metallic particles in the toning-bath is great, their nature and action subtle, and as yet very imperfectly ascertained. *The operator will do well to avoid dipping the fingers into this solution,* and to

Frequent examination.

Fixing baths.

Necessity of a pure hypo bath.

Removes the chemicals from the paper;

and is *itself* soluble in water.

Care in washing.

TONING. avoid contact by the use of the horn tongs, as the neglect of this precaution will have unpleasant results. The prints are now to be withdrawn and immediately put into clear cold water, the *softer* the quality the better. Too much attention cannot be given to the complete manner in which they are turned, and the waters changed continually, *especially at first*. It will be evident that if they are allowed at the commencement to remain in a shallow tray, with a small quantity of water, they would in reality only be in a weak solution of hypo, which would be acting upon and deteriorating them. The changing of the water, if a running stream—which is infinitely better—cannot be procured, must take place in *large earthenware* or gutta percha vessels, at something like the following intervals:

Contact dangerous to health.

Approximate intervals.

¼ hour; ½ hour; 1 hour; 2 hours; 4 hours; 8 hours; 12 hours.

Thus changing them, as will be observed, the more often as they have more recently left the hypo solution. At the end of this time, remove them from the water; drain each for a few seconds; then *blot them off between sheets of clean blotting-paper;* and either suspend them to thin cords to dry—for which purpose the wooden "American clips" are useful,—or lay them on a sheet. When dry, either pass a *cool* iron over the backs to flatten them; or, better, put them for a night in a press. They are now ready for the mounter.

Modes of drying.

NOTE, that more than twenty-four hours in water is entirely useless, and even detrimental to the prints, provided that they have been *well*

changed. A continuance of long periods in water, is sufficient *of itself* to produce *visibly* deteriorating effects: also, that any attempt to wash them in painted or japanned vessels, or those made of lead, zinc, or other metals, will result in the immediate destruction of the proofs. TONING. Destructive vessels.

The prints carefully taken by this method are, as before stated, *permanent,* under very moderate conditions of care. Their whites are generally not quite so pure as those of the next process; much of this, however, and indeed *their permanence* depends upon the employment of *new clean* hypo finishing solution. Permanency of prints.

Prints above twelve years old, toned by this method, are now before the writer as perfect as the first day they were finished. Having lasted that period unaltered, there seems no reason why their permanency should not endure much longer under the same conditions which have brought them so far unscathed. Proved by experience.

THE ALKALINE GOLD toning process was first introduced by Mr. Waterhouse. The object it has in view is to avoid sulphuration of the prints by *first* fixing them; thus removing the portion of chloride of silver unaltered by the action of light, and subsequently toning that remaining with an alkaline solution of gold. The advantages claimed for this method are a greater permanency of the prints than in the toning process previously described; on this point opinion is beginning to be much divided. Many contend that the proof of their stability, which has been established by the time elapsed since they were printed, and Alkaline gold process. Opinions thereon.

TONING. which now finds them unaltered, tends to favour the old method. There are two points—apart from this primary desideratum—which are in favour of toning by the alkaline process, namely, the purity of the whites and the economising of chloride of gold.

Mode of operating. The print on removal from the pressure frame is, in yellow light, washed in common water, of as soft a quality as procurable—*clean rain water* has very decided advantages—until the soluble nitrate is dissolved out. It should, for this purpose, be placed *face downwards,* moved continually, and the water changed several times during the process; the anti-final water should have some common salt dissolved in it, but the subsequent one should have removed its traces from the surface.

Method of toning. The toning bath having been poured into a flat porcelain dish, the washed prints are laid in it, two or three at once—the fewer the better—and the solution is kept in *constant motion* on their surfaces by rocking the dish. The rapidity of action is dependent on temperature, and on the strength of the gold solution, and requires very careful watching. They must have well taken the purpling colour of the gold when held up and examined, both by diffused and transmitted light, or when they are subsequently acted upon by the fixing bath—as they partially lose this tone—they will be too red. It is desirable to see the precise colour by *natural* light, for an instant, since the appearance by the *yellow* light of the operating room is deceptive. This must be done

with caution, and not towards full sunshine. TONING.
Wash in clean water, and fix in *clean* hypo and water. They must be held up to the light, and all "measley" spots which denote imperfect fixation, have entirely disappeared from the paper; "Measley" spots.
the precautions taken in washing them are similar to those of the other silver process.

PART VI.

SOLUTIONS AND CHEMICALS.

NITRATE BATH.

Importance to the manipulation.

THE NITRATE BATH.—The most important of all the solutions to the photographer, is undoubtedly the Nitrate Bath. Its contamination by contact with any organic substances, or by neglect of any kind, is so fatal to success, that the merest tyro in the art soon becomes imbued with profound respect for his bath. But as the reader may not be aware of the precautions which have been found in practice to be necessary to its preservation in the best working order, the following remarks are offered:

In saying *the* Nitrate Bath, the writer must be understood as speaking generally of the solution, for as the artist, to serve different requirements, uses first one pencil, then another, of a different degree of hardness, so ought the intelligent photographer to utilise various qualities of bath solution most adapted to the treatment of the subject taken in hand; and it would be as idle to suppose that one diameter or class of lens should fulfil in perfection all requirements, as it would be to apply one state of bath solution, or one condition or quality of collodion to their varied nature.

Various conditions necessary.

In a very laudable spirit of research, at various times different additions have been proposed to be made to the bath, and each, for a time, has

enjoyed a certain vogue, only ultimately to be consigned to oblivion. As far as our present knowledge extends, the student is therefore advised not to dabble in doubtful experiment, but strictly avoiding *messing* of all kinds, to keep this important solution free from extraneous contamination. If this is done with intelligence, there is, in the writer's experience, no reason that the operator should not prepare his plate to treat his subject with the same degree of certainty that the artist opens his colour box.

Experiments thereon.

The subjects requiring the most absolute degree of purity and sensitiveness are instantaneous and quasi-instantaneous pictures, astronomical and microscopic photography, *obscure* interiors, and copies of pictures by the old masters.

Greatest nicety.

For this class of subjects thirty grains of recrystallised and *fused* nitrate of silver absolutely *neutral, i. e.,* that in testing with litmus paper both normal and reddened, no change is caused, both the papers remaining *in statu quo.* For INSTANTANEOUS pictures, the writer never does other than add the crystals to the requisite amount of aqua dest., leaving a collodion film in the solution for a few hours: the rationale being that, as the solution is absolutely *neutral,* and as the excited film, unless *immediately exposed,* is, for the process, valueless, no time is given to form the pinholes, which a more *acid* state of the bath solution, and a considerably *prolonged exposure* would generate; whilst, to experimental test, the film is more sensitive than if the bath solution had been iodized in the usual method. For the remaining

Various treatments.

NITRATE BATH.

subjects the same ingredients, iodized in the usual manner. Early and late in the year the writer has successfully employed forty grain solution for instantaneous pictures, interiors, and copying pictures, the temperature very low, and the radiations weak to the film, but except under those conditions thirty grain is sufficient, and avoids a tendency to fog.

Low temperature.

PORTRAITURE AND LANDSCAPE.—Thirty grains solution of recrystallised nitrate iodized, just acid, making the distinction, in landscape, that extended views over distant country require, to avoid fogging, and to give *clear* delineation of distances; an older bath, and a more insensitive sample of collodion than deep glades, dells, and obscure mountain passes, to which intent both portraitist and landscape photographer should have at least *two*—better several—baths, some much more recently prepared than others. Still-life, *sun-lighted*, architecture, and *print* copying, will be advantageously treated by exciting rather highly coloured samples of collodion in a slightly more acid solution than the preceding subject, the object being to keep clear brilliant definition from those originals.

Varying requirements.

The bath solution should be kept in *glass only*, and subjected to no more *filtration* than when and absolutely *necessary*. For example, after considerable use, the bath is "out of order," *i. e.* the negatives are streaky, stained, &c., it "wants a rest;" why? Because it is super-saturated with ether, &c. &c. If this bath is left in the trough for some time, a dark precipitate will be

Precautions necessary.

found deposited all over the glass; now if the student proceeds to excite a film, the motion of the dipper and the disturbance of the liquid will detach numerous particles, which will attach themselves to the surface of the film, causing there the blemish shown at fig. 54. The proper treatment for such a bath is to pour it from the trough into a bottle, leaving the stopper out; tie a muslin over the neck—to keep out dust—which permits evaporation of the ether; put it in full sunlight; after some days, when the heavy dark deposit has attached itself to the bottle, ***decant gently*** back into the glass trough, cleared out chemically and thoroughly in the interval; test and add either solution of sodæ bicarb., or take a clean glass rod, dip the end of it in nitric acid and aqua dest. solution, and stir.*

NITRATE BATH. **Out of order;** **means of restoring.**

It is necessary occasionally to test the solution with the argentometer, and to repair waste of strength with fresh crystals of nitrate. It will probably be found that the bath has, for certain subjects, now recovered its desirable action; if that however should not be the case, instead of adding no end of advised nostrums which seem only to stop short of oil and vinegar—the best way to save the operator's time and spare his patience under disappointment, is to add common salt to the solution, and add the precipitated chloride to the residues to be subsequently recovered.

If unsuccessful, **convert to chloride.**

* Placing the bottle in the sun has the effect of *raising the temperature* and facilitating the escape of the disturbing elements on the one part, whilst deposition does so with the remainder on the other.

NITRATE BATH.

For instantaneous pictures.

For *instantaneous* work, the bath will not long continue in perfect order; luckily the size of the pictures being *small*—the contents of the trough is under twenty ounces—makes the *necessity* of frequent *entirely new* solution less onerous; the more so, as although unfitted for the niceties of the above very delicate manipulation, and for astronomical and microscopic photography, it is in the most perfect order for any of the other requirements, and can be bottled and kept for those uses. As before mentioned, the student had better not think of a single bath; if he intends successful manipulations, three or four troughs with *different states* of bath to be taken up as required are not too many, supplemented with more in bottles, labelled with the *precise data* connected with the contents. If to this arrangement his varying samples of collodion be judiciously adapted, more or less sensitive, according to the requirements of the moment, and he is orderly and exact in manipulating, he will meet with little disappointment.

Orderly arrangement; the contrary.

The points to observe are—to avoid all *messing*, *i. e.* unnecessary filtrations—*all* paper is doubtful with this solution; *decant* in preference. Keep the bath *always covered*, the *dust* of an operating room is hyposulphite of silver, &c. &c.; mind that chemically unclean hands touching the wet dipper, or coated plate, do not add minute, but sensibly deteriorating and accumulating destructives to the solution.

The writer has found much advantage in keeping pulverised and *sifted* glass—of the size of hemp

seed—in a layer about an inch deep, at the bottom of the bath. It acts on floating particles by attraction, and their subsidence, in the interstices, relieves the solution from what would be the nuclei of blemishes on the collodion film. It should occasionally be taken out, well shaken in a bottle with sol. nitric acid and water, repeatedly rinsed, finishing with aqua dest., and replaced. NITRATE BATH. Useful expedient.

The chemicals which enter into the composition of the Nitrate Bath should be of the most *undoubted purity*, which is best attained by purchasing them *only* from vendors of character and respectability, who making it especially their concern to procure them for photographic uses, will, by testing and otherwise, insure their quality. Quality of chemicals.

In preparing the solution, if the bottles to be used are *new*, they must be cleaned by having a weak solution of nitric acid and water shaken in them, and afterwards *well rinsed*—first, in common, secondly, in distilled water. The measures, funnels, spoons, and glass rods must be *scrupulously clean*, and none of them must have been used with solutions of hyposulphite; indeed merely putting a stopper down on a table on which hypo had been spilled, and returning it to a bottle would suffice to spoil a bath. The above method of cleansing *new* bottles applies equally to *new* glass baths. Bottles, &c., cleansed.

We now proceed (in a *yellow light*) to prepare the solution. Mode of preparation

It is to be made in the following proportions: Into a stoppered bottle put—

NITRATE OF SILVER.

Nitrate of silver	. . .	1 ounce.
Distilled water .	. . .	2 ounces.
Dissolve.		

Into a glass measure put

Iodide of potassium .	. . .	4 grains.
Distilled water .	. . .	1 drachm.

of the bath solution.

When dissolved, pour it into the bottle. The precipitate of iodide of silver forms in curdy flakes, which, on well shaking, are entirely dissolved. Now add fourteen ounces of distilled water, when the excess of iodide of silver is again thrown down, but in such a finely divided state as to render the saturation of the bath with iodide of silver perfect. Allow it to stand half an hour or so; carefully filter; it should then be as bright as distilled water.

NOTE, that the bottle in which it is prepared should be larger by one-third than required for the solution, in order to give room for thoroughly shaking it.

NITRATE OF SILVER.—Two varieties of this salt are in general use. The cheaper and most extensively used nitrate is prepared by the refiners from their waste liquors, &c., from which formerly the silver was recovered by first converting it into chloride; as met with in the shops, it is in rather small irregular-shaped crystals, having a white effloresced appearance, and being more or less opaque; it is seldom quite pure.

Various qualities.

Impure.

In this state it is available and can be used for the printing processes, but not for the nitrate bath solution. Recrystallization, whereby it is relieved from acidity and impurity, is necessary

to fit it for this purpose. A marked change is now observable in its appearance; in the former state the crystals which were small, opaque, and irregular, are now seen, in the *best prepared* samples, to be very large, thin, flat, tabulated, and transparent, and to have lost the smell of the mother acid, which was before strongly perceptible. For the nice processes, for which its use has previously been enumerated, careful fusion in addition is desirable. If this is attempted by the amateur it must be most carefully manipulated. On a retort stand (see page 101) place a hard German porcelain saucer; in it a *small* quantity at once—say two or three ounces—of the *re-crystallized* nitrate, reduced to a fine powder in a glass pestle and mortar; light a spirit lamp beneath and stir continually with a glass rod. As soon as fusion is accomplished cover instantly with a piece of glass, blow out the lamp and leave the mass to cool. Note that the presence of *minute* particles of organic matter, in any shape, will *spoil the whole.* The remarkable sample prepared by Messrs. Hopkin and Williams has been previously noticed.

IODIDE OF POTASSIUM.

Appearance when re-crystallized.

Method of fusing.

When nitrate of silver is dissolved in excess of ammonia, the solution should be colourless. As nitrate of silver readily spoils by exposure to light in contact with *organic matter*, great care should be observed in the keeping of this salt, a small fragment of cork, or a little lint, from a cloth, being capable of spoiling any quantity.

Precautions for its preservation.

IODIDE OF POTASSIUM, being prepared by mixing carbonate of potash with iodide of iron, fre-

Its mode of preparation.

quently contains a little of the former salt. When pure it is in crystals of the form of a cube, and causes no precipitate if dissolved in lime-water.

How tested for purity. DISTILLED WATER is tested for purity and freedom from contamination by organic matter, by dissolving in it a crystal or two of nitrate of silver; held in bright light it should remain limpid as before, any cloudiness appearing would show it to be unfit for the preparation of the nitrate bath, &c.

ALCOHOL is a limpid, colourless, inflammable liquid, having a peculiar and penetrating odour. Specific gravity. Its specific gravity at 60° Fahr. is 0·7947; at 68° Fahr. it is 0·792. No means of solidifying it are known.

Alcohol has a strong affinity for water; hence Preparation. it abstracts this fluid from the atmosphere. It is prepared by the chemist from the rectified spirit purchased from the rectifier. It is obtained by adding chloride of calcium, carbonate of potash, or well burnt lime, to the spirit which is thus distilled. The salts or lime retain the water whilst the alcohol distils over.

Its uses. In photography, alcohol is used in several solutions; but, where required to be of the most *absolute purity* is in the additions made to the collodion. Should it contain water, the quality of the film will be thereby greatly deteriorated.

SULPHURIC ETHER is prepared by the distillation of rectified spirit and sulphuric acid. It is Mode of "washing." rectified from water, sulphurous acid, &c., by the addition of carbonate of potash and re-distillation. It is a colourless, limpid fluid, having an agreeable

fragrance. The ether of the shops contains a little alcohol, and its specific gravity varies from 0·733 to 0·765. COLLODION.

Newly washed for photographic use, its specific gravity at 60°, Fahr. is 0·720 to 0·725, and it should not redden litmus. Pure and recently prepared ether possesses neither acid nor alkaline qualities; but by exposure to light and air, it absorbs oxygen, by which acetic acid and water are produced. Specific gravity.

The ordinary ether of commerce is contaminated with either spirit or water, or both. Caution must be observed in approaching a candle near the unstoppered bottle, as its vapour is highly inflammable. When containing water, &c.

COLLODION.—Much of the success of the photographic manipulation depends on the nature of the collodion employed; the qualities most desirable for it to possess are, that the film laid from it should be even, and free from all reticulations, specks or marks of any kind whatever; that it should flow freely and evenly, that it should be very sensitive to the *obscure* radiation from the subject; whilst the deposit it gives on the highest lights should not be of too great opacity; that it should remain for a considerable period colourless and sensitive. Importance in the process.

If in portraiture, and pictures from the life, it is insensitive, the skill of the operator will not avail him, and not only will the expression of the sitter become heavy and unpleasing, from the time necessary to take the picture, but the light and shade will be faulty and disagreeable, and the whole picture unsuccessful. Desirable qualities.

COLLODION. Whilst in copying chalk drawings, prints, and most especially for microscopical and astronomical purposes, if the collodion used is not perfectly structureless and clean in the film it gives and the image it presents, it will be valueless for those uses.

Defects.

It is better to purchase it prepared by those whose sole care it is to procure the necessary ingredients of undoubted strength and purity, and to give their exclusive care to its preparation.

Different states.

Collodion varies much in its qualities, according as it may have been more or less recently iodized; if intended for portraiture, &c., twelve to twenty-four hours is the best time to use it after iodizing; the qualities it then possesses are—*more sensitiveness* and *less intensity*—which latter is advantageous, since in printing from the resulting negative the light permeates through the highest lights, which are thereby full of forms and gradations of tone. The same state is proper for interiors, instantaneous pictures, and all subjects difficult by their local colours or illumination.

For various purposes.

Landscapes, architecture, exteriors, stereoscopic pictures (being executed with small rapid lenses and requiring extremely clear definition on a diminutive size), still life, statues, &c., will be better treated by collodion in the middle state, which allows longer exposures without fogging, gives greater intensity and clear definition, but necessitates more time than the first.

Whilst chalk drawings, prints, maps, fac-similes of MSS., &c., will be advantageously taken with a sample long iodized and insensitive to half tones, but giving bare glass and intense deposit.

The operator will find appropriate uses for samples in all stages of iodization, and they may be advantageously combined to meet certain requirements, or by having *two* or even *three* baths in different states of *neutrality*, moderate and greater *acidity*, very excellent pictures will be obtained, since by the skilful and judicious combination of *their* qualities with varying states of collodion the operator may so modify his means as to meet *every requirement* in the manner the most advantageous to the subject undertaken. Caution is required in not approaching too near lights with unstoppered bottles of collodion, its vapour being almost as inflammable as that of ether.

TONING BATH.

Mixing.

Different baths.

Precautions.

THE TONING BATH (*for original silver process*).—The solution for giving the desired degree of colour to the proofs, is composed in the following proportions.

Formula for solution.

Clean water	10 ounces.
Hyposulphite of soda	5 ounces.
Chloride of silver	40 grains.
Chloride of gold	10 grains.

Dissolve the hypo in eight ounces of the water, add the chloride of silver, stir well; take a *clean* developing glass, put in it the ten grains of chloride of gold, add the remaining two ounces of water, dissolve, and stir well with a *clean* glass rod, now keeping the first solution in motion by stirring it *briskly*, add the second with a sweeping motion, which shall *at once* intimately mix it with the hypo (not pouring it in one spot). The sooner it is used the better, indeed, the gold

Mode of preparing,

TONING BATH. should only be added immediately before it is wanted.

and keeping. This solution must be prepared in a deep yellow light, and kept strictly in the dark; when *new*, the above is the formula, afterwards, the chloride of silver will not be needed, being supplied from the proofs, as they are toned in sufficient quantity. When quite freshly prepared, the tones obtained are not agreeable, being too gay and purpling in colour; on further use these will give place to fine deep shades of violet brown, approaching black.

Desirable colours.

There are several conditions which must be carefully noted as affecting this manipulation. First, the bath must be tested each time before using, and if more than *slightly* acid, it must be corrected with drops of solution of carbonate of soda in distilled water—testing between each addition—until nearly neutral; were it in much excess of acidity, the half tones and delicate markings of the subject would be injured or effaced. Next, on the state of *temperature* depends greatly the time required for toning, varying from ten minutes, at 80° Fahr. to two hours at 40° Fahr.

Tested for acidity.

Affected by temperature.

The lighter parts of the subject are better preserved when the time occupied in toning is not too much prolonged; therefore, in cold weather it is well to raise and keep up the temperature of this solution to 60°.

Those who print in large numbers would find a pewter hot water case, communicating with a boiler, on which to place the Wedgewood tray,

Expedient for equalizing.

TONING BATH.

advantageous; when merely a limited number of proofs are required, the following expedient will be found quite satisfactory. Take a *deep* Wedgewood tray, a size smaller than the one containing the toning solution, fill it with boiling water, and stand the tray with the bath upon it for half an hour before using; the temperature should show an increase of 20° in winter. As has been previously said, the *fixing* bath of hypo gradually becomes a *toning* bath, by the accumulation of the portions of the latter which it acquires, and thus partially or entirely saturated, it is unfitted for its purpose of *clearing the proof from the toning chemicals.*

Continual changes.

The manner which the writer has found very satisfactory to manipulate this part of the process, is as follows:—have *three* Wedgewood dishes,

Mode of operating.

No. 1.	No. 2.	No. 3.
The Toning Bath.	The Middle Bath.	QUITE NEW and clean Hypo fixing sol.

The proofs having *nearly* acquired the proper tone in No. 1, are passed on to No. 2, when a considerable portion of the yellow colour in the whites is seen to be discharged, whilst the darks acquire cooler tones; having remained according to the temperature, as previously directed, they are to be *passed through* water to remove the solution from their surfaces, and placed in No. 3;

TONING BATH.

Permanency. here they will be observed to become silvery in the darks and absolutely white. If now they are properly washed, as elsewhere directed, *they will be permanent.*

Proofs taken *direct* from No. 1, washed and dried, will fade in a few weeks.

Proof *passed through* No. 2 may last a few months.

Various qualities. The writer *has not known a proof* toned and fixed as mentioned, and subsequently *thoroughly* washed, *to fade,* although many of them are freely exposed to the gases of a London atmosphere.*

The other advantages of this treatment are, that before No. 1 solution becomes stale, and gives tones deficient in freshness, it is withdrawn and renovated by the continual additions from No. 2, which, in its turn, is improved from No. 3; where entirely NEW AND CLEAN hypo is being placed, the *intermediate* bath prevents the fixing from being so quickly contaminated—thus saving trouble and expense—and at the same time is preparing itself to take the place of the toning.

Benefit of *three* solutions.

Between each batch of prints, which should be in small quantities (not more than ten), addition of gold to the bath is necessary, in the ratio of two and a half grains to each twelve by ten print. Manipulate strictly as follows: take one ounce of NEW *saturated* sol. hypo, add to No. 1,—into two ounces of water put twenty-five grains of chloride of gold—dissolve. Now, stirring as before directed,

Continual addition of gold *necessary.*

* This reiterated on the experience gained by the time now elapsed since the assertion was made in the former edition.

put in the gold solution, and tone a surface of prints equivalent to ten of 12·10. The *saturated* sol. hypo, balances *the water* introduced with the gold, and the weak additions from the other trays. SOLUTIONS.

Alkaline toning solution.

THE TONING BATH (*for the alkaline gold process*) in the following proportions:

To *hot* water	10 ounces.
Add carbonate of soda . .	15 grains.
When dissolved—	
Add chloride of gold . .	1 grain.

to be prepared an hour or so before required. As this solution does not keep, only the quantity required for immediate use must be made.

How prepared.

CHLORIDE OF GOLD is produced by dissolving pure gold in nitro-hydrochloric acid. The deep yellow solution thus obtained yields, by evaporation, yellow crystals of the double chloride of gold and hydrogen; when this is cautiously heated, hydrochloric acid is expelled, and the residue, on cooling, solidifies to a red crystalline mass of ter-chloride of gold, very deliquescent, and soluble in water, alcohol, and ether. When pure it is of a very deep orange colour; for photographic use it is better purchased in *small* hermetically sealed glass tubes, containing each about fifteen grains, as, if exposed in larger quantities to the atmosphere, it will become deteriorated by deliquescence, caused by the removal of the stopper.

Colour of the crystals.

How best preserved.

How soluble.

CHLORIDE OF SILVER is a chalky-looking, white powder, insoluble in water and nitric acid, but soluble with ease in cyanide of potassium, hyposulphite of soda, and ammonia. It is procurable

SOLUTIONS. by adding a saturated solution of common salt to a solution of nitrate of silver. It falls as a white, curdy precipitate, which, well washed and dried, is chloride of silver.

Decomposed by light. It is decomposed by light both in a dry and wet state; very slowly if pure, and rapidly if organic matter be present.

DEVELOPING SOLUTIONS.—That for cadmium, or simply iodized collodions, is prepared in the following proportions: (Proportions.)

Distilled water . .	1	10	20	40	ounces.
Pyrogallic acid . .	3	30	60	120	grains.
Acetic acid . . .	½	5	10	20	drachms.
Alcohol . . .	⅛	1¼	2½	5	drachms.

"Three grain" solution. Mix the distilled water and the pyrogallic acid, filtration is unnecessary; *now* add the alcohol and acetic acid. When made in these proportions it keeps better than when prepared of less strength. It is easily diluted as required to meet circumstances of light and temperature.

Light and heat injurious. It should be kept from the light, and, in summer, in a cellar; in cool weather it will keep a month or more; in summer a week or ten days; a slight discoloration is of no consequence; but, if it passes beyond, its power of developing slight action on the film is impaired. For instantaneous work, it is better quite recently prepared.

FOR IRON DEVELOPMENT of bromo-iodized collodions, developing solution No. 1.

Protosulphate of iron . . .	300 grains.
Glacial acetic acid	1 ounce.
Alcohol	2 ounces.
Distilled water	20 ounces.

Filter.

Intensifying solution, No. 2.

SOLUTIONS.

Solutions for iron development.

Pyrogallic acid	3 grains.
Citric acid	1 grain.
Glacial acetic	¼ drachm.
Distilled water	1 ounce.

When the image has *well come out*, under the application of No. 1, wash the plate thoroughly, and examine it, by holding it vertically up to the (yellow) light. Should it appear sufficiently dense—which, in *small sizes*, in some conditions of light and exposure it may—wash and fix it. Generally the deposit will be too weak to give a bright print, in which case wash *well*, and according to the size of the negative, pour into a developing glass sufficient of No. 2 to cover the plate; rock it backwards and forwards several times, and return it to the developing glass; now add to it, according to quantity of solution and temperature, drops of a thirty grain plain sol. of nitrate of silver in distilled water; give the developing glass a rotary motion to well mix, return the solution on to the negative, and keep it in continual motion, till sufficient density of deposit is obtained by its means. Sometimes, before the requisite density is obtained, this solution becomes turbid, in which case it must be poured off the plate, and a fresh quantity applied in a similar manner. This operation may, when necessary, be several times repeated, until the requisite power is obtained.

Mode of operating.

PYROGALLIC ACID is prepared by heating quickly tannic or gallic acid, previously well dried; it is obtained as a sublimate in white plates or needles,

How obtained.

SOLUTIONS. Tested. possessing a strong empyreumatic odour and bitter taste. It should not redden litmus, and should not be kept in solution.

Glacial unnecessary. ACETIC ACID.—This is seldom really *glacial*, nor is it, indeed, very important for the collodion process that it should be so. The presence of a Useless expense. very small quantity of water halves the price of the acid, and is not worth consideration. In its most concentrated form it should be solid at 60°, but when of this strength it is expensive.

THE EXCITING SOLUTION FOR PRINTING is composed of—

Nitrate of silver	. . .	60 grains.
Distilled water .	. . .	1 ounce.

Strength for thick papers. If thick papers are used, such as Papier Saxe, eighty grains, or more, of nitrate will be required to give good results.

This solution will rapidly become weaker,* and crystals of nitrate must be added to it to keep it up to the requisite strength: it will Mode of discolouring. likewise become discoloured. This, to a certain extent, does not signify; provided the paper excited with it is used at once, as the hypo fixing bath removes such stains from the whites, and leaves them perfectly pure. When more, however, than a mere light brown discoloration has ensued in the solution, it may be removed by the use of "Kaolin," or china clay, which is to be shaken up with the darkened solution, in the proportion of about twenty grains to the ounce of liquid; and it will precipitate the discoloration. The upper portion may then be decanted.

* It must be tested by the Argentometer.

The reader is cautioned against the use of animal charcoal for this purpose; as on floating albumenized paper on a solution so purified, the albumen detaches itself from the paper, and the result is very damaging to the proofs, which are totally deficient in depth and brilliancy. The horn tongs are to be used in this solution. They keep the hands free from stains and the paper in better condition. SOLUTIONS. Animal charcoal destructive.

Pure nitrate of silver should be employed. It is not necessary that it should be recrystallized, as for the bath solution.

FIXING SOLUTION FOR THE FILM.—The above is prepared by saturating any desired quantity of water, according to size of the bath, with hyposulphite of soda; that is, until the water will dissolve no more. It will become discoloured by use, which is of no consequence: indeed, it is better when not perfectly new; its action is less violent on the delicate parts of the deposit. Saturated solution. Better when not new.

FIXING SOLUTION (for printing) is prepared in the following proportions:

Filtered water . . .	15 ounces.
Hyposulphite of soda . .	½ lb., Avoirdupois.

HYPOSULPHITE OF SODA is made by digesting sulphite of soda on flowers of sulphur, at a high temperature. It occurs in white, transparent crystals, and is *very variable* in quality. When good, it should dissolve one half of its weight of iodine; and its solution should give no precipitate with a soluble salt of strontia or lime. Mode of preparation. Test of quality.

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THE END.

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